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The effect of alternative audio and visual presentations on individuals' perceptions of television commercials.

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THE EFFECT OF ALTERNATIVE AUDIO AND VISUAL PRESENTATIONS ON INDIVIDUALS' PERCEPTIONS OF TELEVISION COMMERCIALS

A Dissertation Presented

By

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ABSTRACT

The Effect of Alternative Audio and Visual Presentations on Individuals' Perceptions of Television Commercials

(September 1977)

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The objective of the dissertation is to ascertain whether selective attention processes limit cognitive assimilation of television advertising messages shown under laboratory control conditions. Broadbent's model of selective attention implies that when audio and video stimuli are presented simultaneously, only one stimulus channel is attended. The unattended stimuli from the unattended channel are not analyzed for content, context, or meaning. An implication is that only material within the attended channel influences consumer decision making processes.

Television commercials generally project two or more stimulus channels (e.g., aural verbal script and on-screen printing). It is assumed that advertisers want viewers to attend information on each channel. If these salient bits are presented simultaneously, cognitive limitations prevent

assimilation of both messages.

Three advertising strategy alternatives are indicated by this theory. (1) Single channel designs--during each commercial instant, project 'important' data on one track (e.g., audio) while terminating all secondary input. (2) Incompletely redundant multiple channel designs--simultaneously project related, but incompletely redundant information on more than one input channel (e.g., deploy 'important' aural verbal concurrent with 'important' or 'unimportant' pictorial script). (3) Completely redundant multiple channel designs--present 'important' material on one channel simultaneously with a second channel that is completely redundant to the primary stimulus (i.e., verbal script simultaneously spoken and printed on-screen).

It is postulated that the level and variability of attention and recall are dependent upon the presentation format. Single channels are expected to provide highest attention (recall) and attention (recall) variability. Given an active learning context and moderate projection speeds, completely redundant multiple channels are likely to generate lower recall (attention) and recall (attention) variability. Further decrements are expected when incompletely redundant multiple-channels prevail. This decrement is postulated to be directionally stronger, the more information that appears in the 'unimportant' secondary channel.

The testing employed six versions of a specially designed television commercial. Each of six groups of student subjects viewed one of the treatment advertisements. The laboratory setting involved testing one subject at a time. Attention was not assayed directly. Rather, short term recall was the surrogate measure. Responses to both audio-related and video-related multiple-choice questions were scored. From these data were derived individual and group mean recall and recall variance scores. These statistics were processed via Hotelling T^2 and univariate t-test analysis. Contrary to expectations, the findings indicated greater variance in the partially redundant cases than in the completely redundant one. However, all other postulates were directionally supported and statistical significance was obtained in most comparisons.

Having verified the occurrence of perceptual limitations, the study addresses implications for marketing managers. The relative merits of single versus multiple versus mixed-channel approaches are deemed functions of several variables: information content of the advertisement, focus of the advertising message, redundancy within the advertisement, competitive position of the firm, amount of consumer information search, and stage of the product life cycle. Based upon these findings, appropriate channel strategies are designated.

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CHAPTER I

INTRODUCTION AND LITERATURE REVIEW

Television commercials simultaneously project audio and visual stimuli to viewers. Usually, both of these input channels contain information that marketers want the audience to consciously and/or subconsciously perceive. As implied in the theory, this perception may not obtain unless the audio and video are properly sequenced. Broadbent's theory of selective attention provides the conceptual framework for discussing these perception and attention processes in television advertising.

In 1958, Broadbent [17] postulated that human information processing is restricted by the existence of a limited capacity filter between the recognition and attentive stages of input analysis. It was claimed that in both visual and auditory perceptual systems, the mechanisms function as parallel information processing channels up to and including the point of stimulus recognition. That is, all environmental input (e.g., sounds, visual stimuli) can be received and recognized simultaneously. Recognition, in this context, refers to pre-categorical analysis of the stimuli. That is, certain physical features are discernible (e.g., pitch, size), but not content, context or meaning.

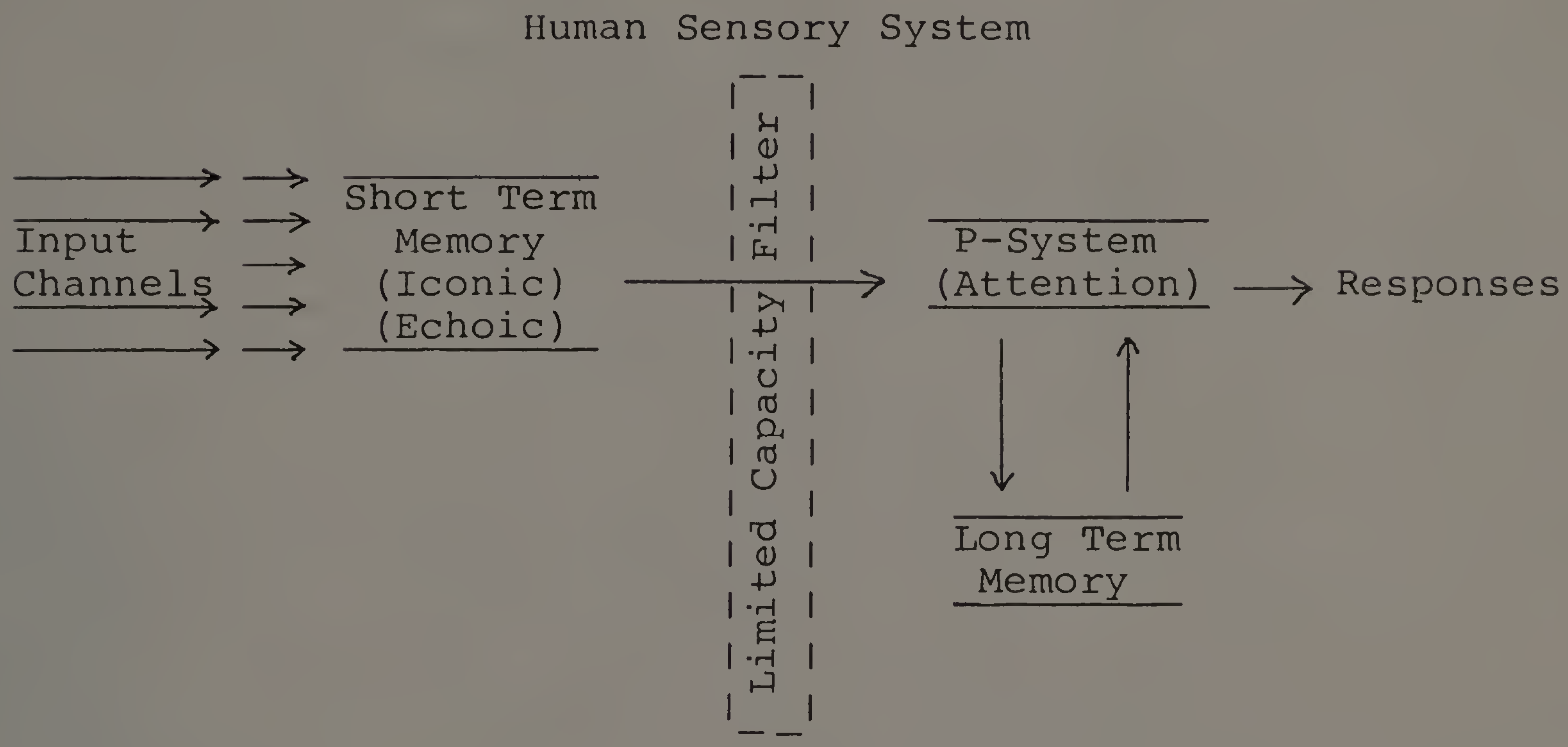
While being so analyzed, input stimuli are held in one of two short-term shortage (STS) mechanisms: echoic memory for auditory material and iconic memory for visual stimuli. We attend to only a limited amount of information stored within STS. As shown in Figure 1.1, it is claimed a filter mechanism allows only one message at a time to pass from STS into the attention system (P-system). Only when the message is attentively processed will the filter allow another stimulus input to enter the P-system. For example, if the environment includes two human speech tracks, only one at a time can be attended. Attention may be switched between stimuli, but at any given time attention is being paid to but one stimulus channel.

Treisman [123] and others modified Broadbent's model to incorporate findings that some material (e.g., one's own name) from the unattended channel does break through into active attention. The modified version states that stimuli in unattended channels are severely attenuated (but not terminated) by our perceptual mechanisms. Hence, only crude analysis of this material is conducted. By contrast, the attended channel input is fully analyzed as to content and meaning.

It should be noted that other theoreticians (e.g., Deutsch and Deutsch [30] and Norman [91]) reject the Broadbent type model. Instead, they claim competition at the response and not the perceptual level accounts for those in-

FIGURE 1.1

MODEL OF SELECTIVE ATTENTION PROCESS



formation processing limitations observed.

The implications of Broadbent's analysis for audio-visual (AV) presentations are clear. At any point in time, only one among the audio (A) and visual (V) channels are fully analyzed. Moreover, if V consists of printed material superimposed upon a moving background visual scene, only one of these two visual channels can be attended. Similarly, if the auditory format consists of speech and music, only one will be fully analyzed during any instant. The effects upon recall of these between-channel interferences are likely to be greater as the speed of presentation quickens. When information is arriving at a slow rate through more than one perceptual system, all that reaches the point of recognition may enter the P-system. Complete absorption obtains because the multiple sources together provide less information than the system can handle. However, as the amount of information from the sources is increased, the P-system will eventually reach the point where it cannot handle both sources. When that point is reached, the P-system will accept the message from only one source and exclude the messages from other sources, thus functioning as a single-channel system.

Most of the literature dealing with film or television projections does not directly address selective attention issues. Rather, considerable effort is devoted to other related matters, namely: (1) the effects of distraction upon viewers' attitudes and information recall; and (2) the relative superiority of A, V, or redundant AV modalities. Literature dealing with the first of these issues is reviewed below.

Effects of Distraction upon Attitudes and Recall

Festinger and Maccoby [40] examined the effects upon attitudes of a persuasive A communication that argued against an opinion to which the subjects (Ss) were strongly committed. Three conditions were tested: the A track alone; A with a weakly distracting film clip; and A with a highly distracting V projection. The data showed that attitude shift was greatest in the highly visually distracting condition, since distraction inhibited Ss' subvocal counterarguing against the persuasive message. Kiesler and Mathog [68], Osterhouse and Brock [94], and Rosenblatt [103] got similar results, finding moderate distraction facilitated auditory persuasion. Moreover, Rosenblatt's data showed that recall was highest in the no distraction case.

Other authors raised questions as to the generalizability of Festinger and Maccoby's 'distraction hypothesis.' For Silverman and Regula [112], whether persuasibility increased with the level of distraction depended upon Ss' perception of its intended purpose. If Ss felt the distraction was intentional, they treated opinion questions following the message as measures of their concentration powers under adverse conditions. This artifact may account for the results obtained by Festinger and Maccoby and others.

Some researchers tried to negate the distraction hypothesis, positing instead that learning theory better explains the results. To them, distraction interferes with the learning of the message communicated. This interference, in turn, affects the extent of attitude change. Gardner [41, 42], for example, found that exposing weakly committed Ss to a persuasive marketing communication under conditions of divided attention did not result in increased attitude change. It is claimed there is no counterarguing to interfere with in this weak commitment case. Gardner also showed that recall of the persuasive message was significantly higher in the no-distraction treatment (Ss listened to the recorded message) than in the divided attention conditions (Ss listened to the message while performing simple manual tasks).

Haaland and Venkatesan [46] showed Ss a persuasive video-taped political message under varying conditions of distraction. Like Gardner, they found that the greatest attitude shift occurred in the no-distraction condition, with the least such change occurring in the double-distraction (visual plus behavioral) treatment. Moreover, the no-distraction groups had significantly higher recall scores than did the distracted groups. Venkatesan and Haaland [129] also used television commercials to test the distraction hypothesis. They found that Ss viewing the intact AV projection recalled both product category and brand name more than did Ss presented the visual distraction condition (Ss heard the commercial's sound track while watching unrelated video).

Bither [11] claims that Gardner and Venkatesan and Haaland did not disprove Festinger and Maccoby's distraction hypothesis. The former dealt with weakly committed Ss, while the latter's hypothesis obtains only when the audience holds a position strongly opposed to that expressed in the persuasive communication. Commitment must be strong enough to induce counterarguing before any effect will be noticed. To test the competing learning theory and distraction hypotheses, Bither [12] showed Ss varying in commitment levels television commercials under several conditions of distraction: (1) intact AV; (2) intact V with A spoken in a heavy foreign accent; (3) intact A with unrelated, mildly distracting V; and (4) intact A with unrelated, heavily distracting V. Recall was greatest in the no-distraction case, next lowest in (2), and worst in treatments (3) and (4). Since the relationship between recall and attitude change was not highly positive, the learning theory explanation of the distraction effects was rejected. As partial support for Festinger and Maccoby's hypothesis, large mean changes in attitudes took place in the higher commitment cells under distraction conditions.

In a later series of experiments, Bither and Wright

[14] studied whether the V track distracts from the A portions of television advertisements. In the minimal visual distraction condition, A was accompanied by visual scenes completely congruent with the narration. The visual distraction treatments consisted of A accompanied by visual scenes irrelevant to the message. Recall was highest in the minimal V distraction case. Recall became progressively lower as the visual scenes were rendered more distracting. The audio distraction condition (V identical to that in the minimal visual distraction film, with narration in a strong foreign accent) generated recall scores insignificantly lower than those achieved in the minimal V distraction treatment.

Among the studies cited, none explored the distractive effects of relevant audio (visual) upon the learning or recall of relevant visual (audio). Rather, the efficacious or deleterious effects of irrelevant V or environmental distractions were studied. Two conclusions emerged: (1) irrelevant V or behavioral distractions have a significant adverse effect upon A recall; and (2) for highly committed Ss, behavioral or visual distractions, while reducing recall, enhanced the persuasibility of verbal messages opposing the committed viewpoint. Audiences watching television commercials are generally not highly committed. Hence, distracting viewers from the primary message is to be avoided. Only relevant A and V should be used. Given this constraint, which presentation format generates highest recall among viewers?

Relative Superiority of Audio, Visual, or Redundant Audio-Visual Presentations

In this dissertation, redundancy is defined as identical information being simultaneously presented on more than one channel (i.e., a verbal message appears pictorially on the screen while the identical words are being spoken by an announcer). The showing of similar material on two or more stimulus channels is called incomplete redundancy. Van Mondfrans and Travers [128] explored the learning of redundant material presented through A, V, and AV modalities. For both slow and moderate (0.6 seconds per exposure) presentation rates, no significant differences were found among the amounts learned using the three different modes, except when the stimulus materials contained little redundancy or meaning. Thus, it was concluded that use of two input channels has no advantage over one in the learning of material which is redundant across modalities.

Severin [110,111], using very long slide projector exposure times (3 seconds), experimented with the learning of names of nature objects. He found mixed results as to completely redundant multichannel communications. For example, when the word 'moose' was simultaneously spoken and printed on the screen, scores were significantly better than when the word 'moose' was spoken while the screen remained blank. However, the A with redundant printing gave results only slightly better than when the words were printed sans

A. Severin also found that multichannel communications which combined words with related or relevant illustrations (e.g., word 'moose' spoken while picture of a moose appeared) generated significantly higher learning scores than did A, V, A with redundant print, or A with unrelated V (e.g., word 'moose' was spoken while picture of a catfish appeared visually) projections. The A with unrelated V format generated lowest scores. Given the long exposure times for input stimuli, Severin's results seem intuitively plausible.

While the above studies criticized the effectiveness of a completely redundant AV display, other experiments generated diametrically opposed conclusions. Hsia [59,60], using forced learning tasks, examined the effects of noise in A, V, and completely redundant AV channels with varying difficulty levels of input information. He found that in the no noise condition, mean recall scores were significantly higher for the redundant AV channel treatment than were corresponding A or V scores. Moreover, the AV channel was also best in terms of reducing or compensating for the effect of distracting noise.

Baldwin [5], working with a motion picture film clip, showed that recall of both A and V messages which were presented simultaneously was positively related to redundancy between A and V. One could infer from this that complete AV redundancy would generate highest recall.

These seemingly contradictory results as to the effectiveness of AV redundancy could obtain because of differences in task structure and speed of presentation. While Baldwin's experiments dealt with a passive learning situation, all the others used forced learning tasks. Clearly, the attentive processes will be different for each type. In forced learning situations, input is actively attended. Hence, multiple channel presentations might interfere with the Ss' concentration, since some between-channel switching is likely to occur. In passive learning, the attention locus is more fluid. A subject (S) is likely to engage in much more switching activity, including switching attention to something other than the AV presentation. Hence, two redundant channels (A and V) are likely to capture more of his (her) total attention time to the message than is one alone.

Concerning presentation speed, both studies which negated AV redundancy used relatively slow slide projections, while Baldwin and Hsia used faster moving film clips. Jester, Hartman, and Schlater addressed the issue.

Jester [62] cited an experiment in which he and Travers presented prose passages to Ss at rates ranging from 150 to 300 words per minute via A, V, and simultaneous AV modes. The results showed a significant increase in learning via the redundant AV mode as speed of presentation quickened. Jester claimed Ss tended to concentrate on one channel only during the redundant AV display. The other information channel was ignored. Hartman [49] reported that his review of multiple channel communication research showed channel interference is predicted when the rate of presentation becomes rapid enough that alternation of attention between A and V channels cannot occur. Schlater [107] conducted experiments which supported this conclusion. He varied speed of V while testing A and V recall. As speed of V presentation increased, A recall declined. These findings imply AV redundancy can enhance recall when stimuli are presented rapidly.

It seems reasonable to conclude that complete multichannel redundancy (i.e., words simultaneously spoken and printed on the screen) can enhance recall in a passive learning task where stimuli are introduced either very slowly or very rapidly to the Ss' sensory system. At moderate presentation rates, some between channel interference is likely. It should be noted that where incomplete redundancy exists, the results are not so clear. For example, Zeigler [132] found that Ss who viewed a series of advertised items on the television screen while an announcer simultaneously discussed them recalled more items than did Ss seeing the same objects while the announcer gave irrelevant information. However, when the visual display of the items was more complex, recall in the irrelevant A case was slightly better than in the highly redundant AV presentation. The first result can be explained by referring to Sadowski's [104] experiment. As to the second, perhaps increasingly complex

V stimuli utilize more of the S's attentive capacities, causing blocking out of the irrelevant channel.

Sadowski [104], repeating studies conducted by Beik [7] with television commercials, found that when V and A are depicting approximately the same thing, V events are predominantly recalled. Conversely, when V and A are uncoordinated (i.e., saying different things), mainly A events are recalled.

Issues Addressed in the Current Study

The current research project focuses more directly upon the issues raised by Broadbent. Interference between relevant A and relevant V channels in television commercials is analyzed. Broadbent's model implies that when A and V are presented simultaneously, only one among these channels is attended at any given instant. Inferentially, content within the unattended channel is not analyzed for meaning. Utilizing these postulates, the author constructs a model which explains the nature of between channel interferences and profers ways to negate their adverse effects upon A and V recall of commercials. Strategy implications for corporate advertisers are also discussed.

A study by Reid and Travers [101] is germane to the research issues. One group of Ss learned ten nonsense syllables through an auditory presentation; another learned the syllables through a V mode; and a third was presented the syllables alternately through the eye and ear (switching occurred once every second). The condition requiring a switching of perceptual channels resulted in a 15 per cent decrement in learning as compared with the treatments requiring no switching. It was calculated that the time lost in switching approximated one-fifth of a second per switch [121]. During those gaps, no stimuli were being attended. These switching limitations imply that recall will suffer if many rapid perceptual switches are mandated. Requiring fewer switches (certainly much less than one per second) will enhance Ss' recall of message content.

CHAPTER II

MODEL OF INPUT STIMULI CHANNEL STRATEGY FOR TELEVISION ADVERTISERS

Broadbent developed a model indicating that humans cannot attend two stimuli at once. With reference to television commercials, the Broadbent paradigm implies that visual (aural verbal) portions can interfere with conscious and/or subconscious perceptions of simultaneously presented aural verbal (visual) tracks. Instrumental and lyrical music, and verbal on-screen printing constitute three additional channels. Interference is likely between any among the five which might be presented simultaneously. To obviate this problem, the author posits a model of input stimuli channel strategy for television advertisers. Built upon the findings of Broadbent and other cognitive psychologists, the mathematical model reveals strategies for enhancing recall.

Assumptions

The following preliminary assumptions are made.

(1) If the subject attends to television (ATV) in any time instant n, he can switch only to not attending television ($\overline{ATV}$) in period n+1. Thus, he will not leave the room

(L) directly from ATV. He must first pass through the intervening step $A\overline{TV}$.

(2) Once the subject leaves the TV room, he won't return.

So, an absorbing state model is used in which the individual can recycle between ATV and $A\overline{TV}$ only. Once L occurs, the subject is out of the system and won't return during the time period under consideration.

The Basic Model

Before an advertisement can have any direct effect upon viewers, it must be perceived at the conscious and/or subconscious level. Hence, an initial objective is to construct advertisements to maximize the probability that people will view them. To quantify this notion, consider the conditional probability matrices in Figures 2.1 and 2.2.

Now, an advertisement is not a single entity impinging upon the viewer's senses. Rather, it is composed of one or more separate stimulus channels entering as input to the receiver's sensory system. These input channels are separated by physical cues including spatial location, mode, pitch and tonal quality. There are five common 'channels' used in TV advertisements: a moving visual layout, verbal printing on the screen, an aural verbal message, and tracks of instrumental and lyrical music. One or more of these channels are employed in any given advertisement.

FIGURE 2.1

CONDITIONAL PROBABILITY MATRIX

Time period n+1

		ATV	$A\overline{TV}$	L	
Time Period n	ATV	$P(ATV_{n+1} \mid ATV_n)$	$P(A\overline{TV}_{n+1} \mid ATV_n)$	$P(L_{n+1} \mid ATV_n)$	$\Sigma=1$
	$A\overline{TV}$	$P(ATV_{n+1} \mid A\overline{TV}_n)$	$P(A\overline{TV}_{n+1} \mid A\overline{TV}_n)$	$P(L_{n+1} \mid A\overline{TV}_n)$	$\Sigma=1$
	L	$P(ATV_{n+1} \mid L_n)$	$P(A\overline{TV}_{n+1} \mid L_n)$	$P(L_{n+1} \mid L_n)$	$\Sigma=1$

where time period n is "instant" before advertisement starts

n+1 is "instant" advertisement starts

(The word "instant" will be defined later in this paper.)

FIGURE 2.2

SIMPLIFIED CONDITIONAL PROBABILITY MATRIX[a]

Time period n+1

		ATV	$\overline{TV}$	L	
Time Period n	ATV	p^b	$1-p$	0	$\Sigma=1$
	A$\overline{TV}$	q^b	r	$1-(q+r)$	$\Sigma=1$
	L	0	0	1	$\Sigma=1$
	where:	$0 \le p \le 1$	$0 \le q \le 1$	$0 \le r \le 1$	

[a]Figure 2.2 is a simplified version of Figure 2.1.

[b]The advertiser's initial objective is to maximize $(p+q)$.

For the sake of generality, assume there are m possible stimulus channels an advertisement can project. Then, the probability that an individual will attend to input channel i in time period n+1 (i.e., at the beginning of the commercial), is given by:

$$P(AC_{i_{n+1}}) = [P(ATV_{n+1})] \cdot [P(AC_{i_{n+1}} | ATV_{n+1})] \tag{1}$$

where

$$\begin{aligned} P(ATV_{n+1}) &= P(ATV_{n+1} | ATV_n \cup A\overline{TV}_n) \\ &= P(ATV_{n+1} | ATV_n) \cdot P(ATV_n) \cup P(ATV_{n+1} | A\overline{TV}_n) \\ &\quad \cdot P(A\overline{TV}_n) \end{aligned} \tag{2}$$

$P(AC_{i_{n+1}} | ATV_{n+1})$ is derived as follows. Define a_i as the attention value weight of channel i to the listener. The magnitude of these weights (arbitrarily let $0 < a_i < 1$) is affected by a number of variables, for example, the time of day and personality characteristics. It is reasonable to assume, however, that weights remain relatively constant over short time intervals. The distribution of weights for different market segment groups could possibly be estimated via questionnaire usage and analysis. Now one can write:

$$P(AC_{i_{n+1}} | ATV_{n+1}) = \frac{a_i}{\sum_{i=1}^{m} a_i} \tag{3}$$

where $0 < \sum_{i=1}^{m} a_i < m$, m an integer.

Verbally, equation (3) says that $P(AC_{i_{n+1}} | ATV_{n+1})$ equals the relative attention value of channel i with respect to all channels present in time n+1.

Thus, equation (1) can be rewritten:

$$P(AC_{i_{n+1}}) = [P(ATV_{n+1} | ATV_n) \cdot P(ATV_n) \cup P(ATV_{n+1} | \overline{ATV}_n) \cdot P(\overline{ATV}_n)] \cdot \frac{a_i}{\sum_{i=1}^{m} a_i} \qquad (4)$$

Equation (4) gives the probability that an individual who was in the television room prior to the commercial will be attending to the projected stimuli channel i at the beginning of the commercial. By summing over the channels we get

$\sum_{i=1}^{m} P(AC_{i_{n+1}})$ is the probability that the viewer is attending to some input stimulus in the television commercial at its commencement.

In a similar fashion, one can calculated $P(AC_{i_{n+2}})$:

$$P(AC_{i_{n+2}}) = P(ATV_{n+2}) \cdot P(AC_{i_{n+2}} | ATV_{n+2}) \qquad (5)$$

where

$$\begin{aligned} P(ATV_{n+2}) = {} & P(ATV_{n+2} | AC_{1_{n+1}}) \cdot P(AC_{1_{n+1}}) \\ & \cup P(ATV_{n+2} | AC_{2_{n+1}}) \cdot P(AC_{2_{n+1}}) \\ & \cup \ldots \cup P(ATV_{n+2} | AC_{k_{n+1}}) \cdot P(AC_{k_{n+1}}). \end{aligned}$$

Thus, equation (5) can be rewritten:

$$P(AC_{i_{n+2}}) = \left[\sum_{j=1}^{m} P(ATV_{n+2} | AC_{j_{n+1}}) \cdot P(AC_{j_{n+1}})\right] \cdot [P(AC_{i_{n+2}} | ATV_{n+2})]. \quad (6)$$

Now $\sum_{i=1}^{m} P(AC_{i_{n+2}})$ is the probability that the viewer is attending to any of the input channels during the second instant after the advertisement begins.

Hence, one can calculate $P(AC_{i_x})$ for any channel i and any time x, where x is some number of "instants" subsequent to the commercial's beginning.

Psychological Foundation for the Model

Most psychologists theorize people attend selectively to input stimuli [17,18,30,31,34,75,82,83,87,90,91,117,123, 124,125,126,127]. While there is some disagreement as to whether selection takes place at the perceptual or response levels [17,18,30,31,90,91,123,124,126], the weight of evidence seems to support the perceptual filter selection mechanism. The theory (outlined primarily by Broadbent [18] and Treisman [123]) postulates that humans are physically capable of attending fully to but one input stimulus channel at any given time. The unattended messages are not totally blocked out, but only limited information therefrom is perceived. Hence, there is analysis of the message content in the attended channel, while there is minimal processing of information from unattended channels.

Moreover, there is considerable evidence [18(Ch.5), 28,71,72,81,82,83(Ch.8)] that it takes time to switch from attending one channel to attending another. Broadbent indicates this switching time is about 1-1/2 seconds. Other experimenters claim a much shorter span [83(Ch.8)]. Moray [28], for example, indicates a switching time of 50 milliseconds (i.e., 1/20 sec) for very simple auditory stimuli. It is also postulated that the rate at which our attention can switch between channels is limited. Hence, if one accepts the notion of a limited perceptual capacity, three conclusions emerge: (a) at any point in time, people attend (almost exclusively) to only one input stimulus channel; (b) it takes time to switch channels; and (c) the channel switching rate is limited. The word "instant" as used in this dissertation is now defined as the discrete, non-zero switching time between channels. This switching interval is 'dead time' in the sense that no stimuli are being attended.

So, at any point in time, an advertisement is generally projecting between one and five stimulus channels to the viewers (e.g., a video sequence along with verbal material would constitute a two channel presentation; adding instrumental music or printing would render it a three channel format). Essentially, however, under the assumptions adopted, only the information along one of these channels is being perceived. Attention can switch back and forth only with the passage of time.

Method for Constructing Advertisements

Selective attention concepts, together with the probability structure outlined earlier, suggest a method for constructing advertisements so that the viewer will perceive the maximum important information.

The first stage is to formulate an information profile of the proposed advertisement. On each input stimulus channel there is some information that the advertiser may want a viewer to assimilate and/or recall (and hence, wants him at least to perceive), with the rest being peripheral in a recall importance context. Hence, for each channel, one can construct Table 2.1. Time can safely be viewed as a discrete variable for this purpose (due to the assumed nonzero switching time between channels). The profile indicates, for each channel i, the time instants that are important:

Important "instants" on channel one $I_1 = \{\bar{a}_1, \bar{a}_2, \ldots, \bar{a}_m, \ldots, \bar{a}_x\}$

Important "instants" on channel two $I_2 = \{\bar{b}_1, \bar{b}_2, \ldots, \bar{b}_n, \ldots, \bar{b}_y\}$

$\vdots$

Important "instants" on channel m $I_m = \{\bar{c}_1, \bar{c}_2, \ldots, \bar{c}_o, \ldots, \bar{c}_z\}$

Now, the probability that the viewer attends to all the I_1, denoted $P(AI_1)$, is

$$P(AI_1) = P(AI_{1_{\bar{a}_1}}) \cdot P(AI_{1_{\bar{a}_2}}) \; . \; . \; . \; P(AI_{1_{\bar{a}_x}})$$

$$= P(AC_{1_{\bar{a}_1}}) \cdot P(AC_{1_{\bar{a}_2}}) \; . \; . \; . \; P(AC_{1_{\bar{a}_x}})$$

TABLE 2.1

INFORMATION PROFILE FORMAT

	information on channel i	
	important to recall	unimportant to recall
0		
time		
end of commercial		

$$= \prod_{i=1}^{x} [AC_{1_{\bar{a}_i}}]. \tag{7}$$

The calculation is similar for $P(AI_2)$ and $P(AI_m)$.

The advertiser's objective can now be restated. He (she) wants to construct an advertisement so that

$$\sum_{i=1}^{m} P(AI_i)$$

is maximized. A key question is whether $P(AI_d)$ is independent of $P(AI_k) \forall$ pairs d,k. At any time j, there are m probabilities of relevance: $P(AC_{1_j})$, $P(AC_{2_j})$, . . . , $P(AC_{m_j})$. Clearly, by the earlier postulation of a perceptual filter and non-zero switching time, if the viewer is in state ATV then he (she) will be tracking almost exclusively one channel i during time j. Hence, for some i, $P(AC_{i_j})$ will be very high and $P(AC_{d_j})$ will be very low $\forall$ channels $d \neq i$. Thus, if any of the $\bar{a}$, $\bar{b}$, or $\bar{c}$ time instants occur simultaneously, only one of the associated probabilities thereof can be high. The other(s) will be very low, thus giving a smaller value for

$$\sum_{i=1}^{m} P(AI_i)$$

than if the $\bar{a}$, $\bar{b}$, and $\bar{c}$ time instants are disjoint. If they are disjoint, then $P(AC_{i_j})$ could be high, while the important other information that <u>was</u> simultaneously coming in on channel $\bar{d}$ would be shifted to another time instant, thus allowing that important information bit a much higher probability of being perceived.

So, ceteris paribus,

$$\sum_{i=1}^{m} P(AI_i)$$

will be higher, the less overlap there is between $\{\bar{a}_i\}$, $\{\bar{b}_j\}$, and $\{\bar{c}_k\}$. This conclusion infers that to maximize

$$\sum_{i=1}^{m} P(AI_i),$$

one must first construct the advertisement so that $\{\bar{a}_i\} \cap \{\bar{b}_j\} = \emptyset$ (empty set); $\{\bar{a}_i\} \cap \{\bar{c}_k\} = \emptyset$; and $\{\bar{b}_j\} \cap \{\bar{c}_k\} = \emptyset$. But disjointness alone is not good enough. The construction model so far depicted ensures only that at any given time instant j, only one among the set $\{\bar{a}_j, \bar{b}_j, \bar{c}_j\}$ is present. Let us arbitrarily assume it is $\bar{a}_j$--so, the advertiser wants the viewer to attend to channel 1 (i.e., C_1) in time instant j. But, unless each of the other m-1 channels provides information completely redundant to C_1 or is terminated, then there is independent input stimuli coming to the viewer from all m channels (redundancy and termination are explained later in the dissertation). The advertiser wants the viewer to attend to C_1, but the viewer has the choice of attending to any among $\{C_i\}$. How can the advertisement be constructed so that $P(AC_{1_j})$ is maximized? Since $\bar{a}_j$ was chosen arbitrarily, answering the question will indicate how to maximize

$$\sum_{i=1}^{m} P(AI_i)$$

(See equation (7)).

The $P(AC_{i_j})$ can be maximized by terminating or severely attenuating the stimuli on all other channels, so that $P(AC_{i_j}|ATV_j) \cong 1$. Recall from equation (1) that $P(AC_{i_j}) = P(ATV_j)P(AC_{i_j}|ATV_j)$. Since there are now fewer stimulus channels being projected from the television, $P(ATV_j)$ likely will decline with each unit decrement in the number of channels projected (m). So, as channels are terminated we have $P(ATV_j)$ decreasing while $P(AC_{i_j}|ATV_j)$ is increasing. What is the net effect on $P(AC_{i_j})$? It is postulated that $P(AC_{i_j})$ will increase as m decreases. Hence, $P(AC_{i_j})$ can be maximized by terminating the remaining input channels.

The viability of termination can be deduced as follows. If an individual is in the television room during a commercial instant j, there is a very large number N of stimuli to which he (she) could attend under normal viewing conditions. Only m of these stimuli come from the television advertisement. Clearly, $P(ATV_j) \neq m/N$ since each stimuli does not have an equal probability of being attended (i.e., stimuli do not have equal attention value to the viewer). Rather, we get

$$P(ATV_j) = \frac{\sum_{i=1}^{m} a_i}{\sum_{i,j=1}^{m,n} a_i + I_j} \tag{8}$$

where I_j is attention value of some non-television stimuli in the room at time j; $0 < I_j < 1$. Using equation (3), one can also write:

$$P(AC_{i_j} | ATV_j) = \frac{a_i}{\sum_{i=1}^{m} a_i} \tag{9}$$

Then, via equation (1), combine equations (8) and (9) into

$$P(AC_{i_j}) = \frac{\sum_{i=1}^{m} a_i}{\sum_{i,j=1}^{m,n} a_i + I_j} \cdot \frac{a_1}{\sum_{i=1}^{m} a_i} = \frac{a_1}{\sum_{i,j=1}^{m,n} a_i + I_j} \tag{10}$$

What happens when m is reduced? Recall the earlier assumptions that each a_i is relatively constant over short time periods, and that $0 < a_i < 1 \ \forall i$. The same assumptions hold for $I_j \ \forall_j$, assuming the environment in the room is reasonably static over the short time interval j. Thus, as m decreases, so does

$$\sum_{i=1}^{m} a_i;$$

and if m=1, then

$$P(AC_{i_j}) = \frac{a_1}{a_1 + I_j} .$$

Under these assumptions, a decline in m will reduce the magnitude of the denominator in equation (10), thus generating an increase in $P(AC_{1_j})$. This increase will be maximized when m=1. By relaxing the earlier assumptions, one might theorize that $m\downarrow \Longrightarrow a_1\uparrow$ and $I_j\uparrow$. However, the increase in I_j would have to be relatively large to generate $P(AC_{1_j})\downarrow$ with $m\downarrow$ even if a_1 remains constant. This reduction in $P(AC_{1_j})$ seems unlikely to occur during short time intervals. As a trivial example, suppose $a_1 = .15$,

$$\sum_{i=1}^{m} a_i = .4,$$

and $I_j = .35$. Then, if m=3:

$$P(AC_{1_j}) = \frac{.15}{.4+.35} = .2;$$

if m=1 (assuming a_1 and I_j remain constant):

$$P(AC_{1_j}) = \frac{.15}{.15+.35} = .3.$$

Even if a_1 stayed constant, I_j would have to increase from .35 to >.60 in a very short time span in order for $P(AC_{1_j})$ when m=1 to be less than $P(AC_{1_j})$ when m=3. The large increase in I_j seems unlikely to occur.

The research objective of this dissertation will be to verify the abovenoted theoretical constructs through experimental procedures. It has been assumed so far that at each instant j there is important information on one channel C_i, with the information projected on $C_i \neq$ information projected on $C_k \forall k \neq i$. Using these assumptions, it has been shown that to maximize the probability that the television viewer perceives all the important information presented on m input channels during a commercial, the important information bits should be staggered (this rate of channel switching should certainly be less than once per second [101]), with other (non-important) channels being terminated or severely attenuated during the transmission of a salient information bit on one channel.

This recommendation does not necessarily obtain if the advertisement employs complete multichannel redundancy (i.e., identical information is simultaneously presented on more than one channel). Logistically, a verbal message appears pictorially on the television screen while the identical words are spoken by an announcer. Here, the viewer will perceive the important information projected if he (she) is attending to either channel, since complete redundancy obtains. Since $0 < P(AC_i) < 1 \ \forall i$, $P(AC_j) \cup P(AC_k) > P(AC_j) \ \forall_{j,k}$. Hence, at any time instant, the probability that the viewer perceives the important information presented during that instant can be increased by using multichannel redundancy. Assume 'important' information is on C_1. By having C_2 redundant with C_1, the viewer is permitted to attend to either stimulus channel and still perceive the message. Only if a third channel or $\overline{ATV}$ is attended will he (she) become a non-perceiver. Clearly, $P(AC_{1_j}) \cup P(AC_{2_j}) > P(AC_{1_j})$, since $P(AC_{i_j}) > 0\ \forall i$. Originally, the information bit was only projected on C_i because this mode was <u>most appropriate</u> for the message conveyed during instant j. Hence, it is <u>still</u> the prime channel. The option now is to attenuate all other C_k, $k \neq i$, or to render some C_d redundant with C_i. Where it can be used, redundancy will enhance the probabilities of interest. Where redundancy is not feasible, attenuation of all 'non important' channels is recommended. As to operational aspects of the redundancy issue, much research has probed the efficacy of audiovisual (AV) redundancy. The results are somewhat conflicting. Several experiments [35,51,54,60,62,70,85,86, 99,113,120] demonstrated that complete AV redundancy generated higher recall or learning scores than did A alone, V alone, or simultaneous AV where A was not fully redundant with V. An issue here is whether the improved performance occurred because one channel reinforced the other or because the subject (S) was free to choose that modality which worked best for him (her). Both positions are compatible with the model.

Another body of research [21,77,110,111,128] found that AV redundancy gave results equal to that obtained in single channel presentations. None of the results used A with moving V displays. Other authors [5,14,15,100,128] claimed that redundancy was uniformly helpful in concept formation. Once again, television broadcasts were not utilized. One experiment [132] concluded that high (not complete) redundancy between A and V generated recall no greater than when A was irrelevant to V. All the above results were obtained in forced learning situations. Watching a television commercial is, at best, a passive learning format. Moreover, very few dealt with television presentations, and only one [132] projected a television commercial. Considering the total package of evidence, it is postulated that AV redundancy enhances the recall of commercial information if the projection rate is either very slow or very rapid. Enhanced recall will not obtain at moderate presentation speeds.

There is one additional major consideration that must be incorporated into the model. Even though $P(AC_{1_j})\uparrow$ as $m\downarrow$, recall that

$$P(ATV_j) = \sum_{i=1}^{m} P(AC_{i_j})\downarrow$$

as $m\downarrow$. Hence, projecting on a large number of stimulus channels increases the probability that the viewer is attending to television and is, consequently, perceiving 'something' in the advertisement, while reducing m lowers the probability that the viewer is attending to television but increases the overall probability that he (she) is attending to 'important' information on one channel. Thus, in the absence of redundancy, the advertiser has a tradeoff. He (she) can choose to have many people attending something in the advertisement. The tradeoff position shows fewer people attending the advertisement, but those remaining attending to the 'important' information presented during each instant j.

Perception Levels

Regarding a product related advertisement, there are several levels of perception which individuals sitting in the television room might experience. These levels can be represented by a continuum (see Table 2.2). The number of channels projected during each instant helps determine which perceptual levels are attained. The postulated distribution of viewers' perceptions for both high and low m values is shown in Figure 2.3. It is assumed that the advertisement is shown only once.

Figure 2.3 is germane to the discussion of tradeoff choices. A large m (i.e., $m=3 \ \forall$ time instants j) will probably generate high recognition of product category and type among a sizable number of viewers. Conversely, a low m will generate high specific product information recognition by a smaller number of individuals, with many viewers not perceiving anything of the television advertisement because they switched to ATV. Thus, within an industry, a dominant or

TABLE 2.2

POSSIBLE LEVELS OF CONSCIOUS AND/OR SUBCONSCIOUS PERCEPTION

Low	1	No perception
	2	Perception (P) of product category (e.g., food advertisement)
	3	P of product category information (e.g., should eat 3 times per day)
	4	P of specific product type (e.g., bread)
	5	P of information about the product type (e.g., should eat bread 3 times per day)
	6	P of specific brand advertised (e.g., Arnold's Bread)
	7	P of some information about brand advertised (e.g., Arnold's Bread should be eaten 3 times per day)
	8	P of most information about brand advertised (e.g., Arnold's Bread contains only natural ingredients and should be eaten 3 times per day)
High	9	P of all information about brand advertised (e.g., all claims about Arnold's Bread)

FIGURE 2.3

LEVELS OF CONSCIOUS AND/OR SUBCONSCIOUS
PERCEPTION AT HIGH AND LOW m VALUES

Percentage of Total Number of Viewers
(designated as high (H) %, medium (M) %,
and low (L) % only)

Levels of Perception		High m	Low m (i.e., m=1)
	1		M
	2	M	
	3		
	4	H	L
	5		
	6		
	7	L	M-
	8		
	9		

leader firm (e.g., McDonald's, Coca Cola) might opt for a high m strategy with the purpose of having a large number of the audience members perceive the product category, and, hence, inferentially, the dominant firm's product by association. Conversely, a firm with lesser visibility might, in line with the model presented, choose a low m strategy. Hence, the tradeoff choice depends upon the objectives and segmentation strategy of the advertiser.

Use of redundancy can enhance the benefits of a low m strategy if the presentation rate is very rapid or very slow, but these 'benefits' may or may not be suitable for firms desiring the high m perception profile. The results might be as shown in Figure 2.4. These conclusions were tested via experiments outlined in Chapter III.

Summary

Many theoretical, empirical and applied issues have been directly raised or alluded to in the first two chapters of this dissertation.

Theoretical Issues

1. Can humans simultaneously attend to more than one stimulus?

2. Does the Broadbent model accurately explain the observed limitations on human information processing?

3. To what extent is the material in unattended

FIGURE 2.4

EFFECTS OF REDUNDANCY UPON CONSCIOUS AND/OR SUBCONSCIOUS PERCEPTION LEVELS

Number of Viewers Experiencing Different Perceptual Levels[a]

		High m m=2 (no redundancy)	High m m=2 (complete redundancy)	Low m m=1
	1	M	M-	M
	2			
	3			L
Level of Perception	4	H	L	
	5			
	6			
	7	L	M	M-
	8			
	9			

[a]H means 'high,' M means 'medium,' and L means 'low.'

channels cognitively processed?

4. Can unattended stimuli affect cognitive processes and behavior?

5. Does learning theory or the distraction hypothesis best explain the effects of relevant and irrelevant distractions upon recall and attitude change?

6. Do conscious perceptions have differing effects upon cognitive processes and behavior than do subconscious perceptions?

Empirical Issues

1. How rapidly can attention switch between stimulus channels?

2. Is information best learned through A, V, completely redundant AV, or incompletely redundant AV presentations?

3. Where AV redundancy enhances learning, does the effect result because one channel reinforces the other, or because the person is free to choose that modality which works best for him (her)?

4. At what presentation speeds do between-channel perceptual interferences emerge?

Applied Issues

1. Is there perceptual interference between relevant A and relevant V channels in television commercials?

2. Can advertising stimuli that are not consciously or subconsciously perceived affect consumer's purchase behavior?

3. Can the viewer's attention be directed to specific information presented in a television advertisement?

4. What are the relative attention value weights of different channels (e.g., aural verbal, printing, instrumental music) used in television commercials?

5. As the number of stimulus channels in a television advertisement decreases, does attention to each among the remaining channels increase or decrease?

6. Under what conditions does complete AV redundancy enhance recall of television commercial messages?

7. Is recall of advertising information presented on one stimulus channel influenced by the amount of information content within secondary channels?

8. Do different perceptual levels result from multiple versus single-channel presentations of television commercials? If so, what are the strategy implications?

CHAPTER III

DESIGN OF EXPERIMENTS TO TEST THE MODEL OF TELEVISION INPUT STIMULI CHANNEL STRATEGY

The first two chapters of this dissertation outline the selective attention paradigm and develop implications for television advertising copy design. In Chapter III, these implications are specified as testable hypotheses. Then, experimental procedures seeking to verify the postulates are described.

Research Problems

General issues concerning the application of selective attention theory to television advertising settings are outlined at the conclusion of Chapter II. The specific questions addressed in this dissertation are as follows.

1. If the number of incompletely redundant stimulus channels employed during any instant in a television advertisement is decreased from two to one, does recall of information presented on the remaining channel increase or decrease? Answering this question will help ascertain whether recall of primary channel information will be higher if all secondary channels are terminated than if one or more are operant.

2. If both a primary and a secondary channel are employed in a television advertisement, does the amount of information content in the secondary channel affect recall of the primary channel message?

3. Under conditions of active learning and moderate presentation speeds, does complete AV redundancy generate higher recall than when single channels (i.e., A or V) are employed during each instant of a television commercial?

4. Is the aggregate variability of advertising message recall dependent upon the number of stimulus channels employed during each broadcast instant?

Research Objective

The research objective of this dissertation is to ascertain whether selective attention processes limit cognitive assimilation of television advertising messages shown under laboratory control conditions.

Research Hypotheses

The following testable hypotheses were developed from the theory presented in Chapter II.

> Hypothesis 1. If audio information is presented without background video (i.e., the screen is blank), more audio material will be attended than if the audio track appears simultaneously with moving background video, stationary background video, or even video completely redundant to the audio.

<u>Hypothesis 2</u>. If video information is shown without background audio (i.e., no sound), more video will be attended than if it is projected concurrent with an audio track, regardless of whether the audio is high or low in information content.

<u>Hypothesis 3</u>. If audio and video information are disjoint, recall of both will be higher than if either audio and video information are shown simultaneously, or if audio material is presented concurrent with stationary background video and then video information is shown simultaneously with background audio.

<u>Hypothesis 4</u>. If audio information is presented simultaneously with stationary background video and then video information is shown concurrent with background audio, recall will be higher than if audio and video information are shown simultaneously.

<u>Hypothesis 5</u>. If audio and video important information (II) tracks are disjoint, with printing completely redundant to A appearing on the screen while the A II is projected, audio and video recall will be higher than if either A and V important information are shown simultaneously, or if A II is presented concurrent with stationary background video and then V II is shown simultaneously with background A. However, recall of both A and V II tracks will be lower if a redundancy format obtains than if A and V are disjoint with no printing on the screen.

<u>Hypothesis 6</u>. The widest dispersion in audio and video recall scores is expected when one channel only is projected during each commercial instant. Conversely, a narrow variance is anticipated when multiple channels are utilized. Medium variability is expected in two-channel presentations where the second channel is completely redundant to the first.

Hypotheses 1, 2 and 3 posit that selective attention is a limiting factor in message recall. That is, recounting of primary channel information will be higher if all secondary channels are terminated than if one or more are operant (regardless of their information content). This recall effect is a direct extension of Broadbent's model, which implies only one channel at a time can be attended for content, context and meaning.

Hypotheses 4 and 5 posit effects from varying the information content in secondary channels. These hypotheses state that primary message recall varies inversely with the information level in other stimulus tracks. This inverse relationship obtains because the attention value of secondary channels is directly related to their information or interest content. The larger their attention value, the less the corresponding value of the primary channel, and, hence, the less likely it is to be attended and subsequently recalled.

Hypothesis 6 deals with aggregate effects of single versus multiple-channel presentations. The hypothesis is actually a verbal restatement of Figure 2.4, which postulates the number of viewers experiencing different perceptual levels. Ss were likely to concentrate more intently than usual on the test commercials. Hence, assuming concentration and recall are positively related, perceptual levels were biased upward. Thus, in developing an operational hypothesis from Figure 2.4, the author decided not to look at perceptual levels per se. Rather, comparing within group variances seemed more logical. The distribution of scores in Figure 2.4 implies that within group variance is a function of the presentation format. That is, widest dispersion is expected when m=1, where many viewers are expected in both the low and high recall categories. The dispersion will likely be narrower in the completely redundant m=2 case, since fewer viewers are expected at the lower recall levels than when m=1. Variability will probably be least in the incompletely redundant m=2 design, where most viewers are likely to experience medium recall.

Highest overall recall was expected when the A and V II material was disjoint. If a passive learning task and very rapid or slow presentation rates obtained, incorporating complete AV redundancy would have probably further enhanced recall. However, a moderate pace was used to make the commercial somewhat realistic. Alternative speeds were avoided because the researcher wanted to explore selective attention processes in audiences viewing somewhat conventional television commercials. Future studies might compare single-channel with completely redundant broadcasts at fast and slow speeds in passive learning environments.

Research Methodology

Experimental Design

To test the research hypotheses, six individual experiments were conducted. A separate group of subjects was employed for each experiment.

Experiment 1. Group one (i.e., G1) was shown a videotape segment containing treatment one (i.e., T1). T1 was a 30 second audio-only advertisement with a blank screen as the visual background. The first 15 seconds contained the audio important information track (II), which consisted of an aural verbal script. The second 15 seconds contained irrelevant, background audio (i.e., instrumental guitar music). This was designated unimportant information (UI).

Experiment 2. G2 was shown a videotape segment containing T2, which was a 30 second video-only advertisement (no sound was projected). The first 15 seconds contained an informative pictorial message (II), while the second 15 seconds consisted of irrelevant, background video (i.e., still shot of a baby eating some cake) (UI).

Experiment 3. G3 was shown a videotape segment containing T3, which was a 30 second audio-visual advertisement. The first 15 seconds consisted of a simultaneous presentation of the aural verbal script (II) and the informative pictorial message (II). The second 15 seconds contained a simultaneous presentation of the irrelevant, background audio and video tracks (UI).

Experiment 4. G4 was shown a videotape segment containing T4, which was a 30 second audio-visual advertisement. The first 15 seconds consisted of a simultaneous presentation of the aural verbal script (II) and the irrelevant, background video track (UI). The second 15 seconds contained a simultaneous presentation of the informative pictorial message (II) and the irrelevant, background audio track (UI).

Experiment 5. G5 was shown a videotape segment containing T5, which was a 30 second audio-visual advertisement. The first 15 seconds consisted of the aural verbal script (II) (the screen was blank). The second 15 seconds contained the informative pictorial message (II) (no sound was projected). The purpose was to present disjointly the audio and video II tracks. There were, of course, many ways to sequence A and V. The goal was not to ascertain the optimal sequence. Theoretically, any such ordering that conformed to the rules of English language, was not perceptually confusing, and did not require rapid back and forth switching between A and V should have generated the results hypothesized.

Experiment 6. G6 was shown a videotape segment containing T6, which was a 30 second audio-visual advertisement. The first 15 seconds contained a simultaneous presentation of the aural verbal script (II) and the printing track completely redundant to it. The remaining 15 seconds consisted of the informative pictorial message (II) (no sound was transmitted).

Experiments one through six are outlined in Table 3.1. In terms of the theory, treatment 1 was a pure m=1 auditory strategy; treatment 2 was a pure m=1 visual design; treatment 3 was an m=2 format with overlap between the presentation of important A and V stimuli; treatment 4 was an m=2 strrategy with important information bits staggered (i.e., disjoint); treatment 5 at any instant was an m=1 design, although variable use was made of m=2 input channels;

TABLE 3.1

EXPERIMENTAL TREATMENTS

Experiment	Commercial Audio Track Projected		Commercial Video Track Projected
1	30 sec.		0
	15 important (II)		
	15 unimportant (UI)		
2	0		30 sec.
			15 II
		shown	15 UI
3	30 sec.	simultaneously	30 sec.
	15 II	-----------S--------------	15 II
	15 UI	-----------S--------------	15 UI
4	30 sec.		30 sec.
	15 II	-----------S--------------	15 UI
	15 UI	-----------S--------------	15 II
5	15 sec.		15 sec.
	15 II (alone)		15 II (alone)
6	30 sec.		15 sec.
	15 R to A	-------S--------------	15 II
	15 II (alone)		

and treatment 6 used both m=1 and completely redundant m=2 formats.

Subjects

Subjects (Ss) were 80 undergraduate student volunteers from the University of Massachusetts at Amherst. Using only students generated homogeneous age groupings. Thus, the mix was somewhat unrepresentative of overall television viewing audiences. Given the physiological nature of these experiments, alternative age compositions would probably have generated different absolute recall scores. However, intergroup comparisons would probably not have been affected.

Commercials

Using an existing television commercial for these experiments would have posed two major problems: (1) subjects would have differing rates of prior exposure, thus generating bias from unequal prior information among respondents; and (2) the experimenter wanted to control the form, rate and level at which material was presented. Hence, test commercials were constructed specifically for the experiments.

Six videotaped segments were developed. All segments were two minutes in length, with the first 80 seconds of each containing the introduction to Happy Days (a popular television program). The purpose of this pre-commercial portion was: (1) to obscure the true nature of these experiments; (2) to relax subjects so they would develop their normal television viewing posture and mental set (It was expected, however, that the experimental setting would generate heightened concentration levels.); (3) to provide a natural framework for the test commercials. The short introduction to Happy Days faded into a network commercial slot. The 30 second test commercials were edited into the videotapes at this point, replacing the regularly shown advertisements. Hence, the treatment commercial appeared to be a normal part of the Happy Days format; and (4) to sufficiently interest subjects so they would attentively watch the television monitor. Subjects reported a high interest level in the Happy Days segment.

The six treatments interjected into the commercial time slot were constructed in the manner outlined below.

Audio Track

Thirty seconds of audio (A) material was videotaped. The first 15 seconds consisted of a male announcer speaking the following words:

> Corn muffin mixes usually give dry, crumbling, unsweet cakes. Not Baxter's Brand with glycerin emulsifiers! Moist, honey-dipped loaves are guaranteed. Twelve and eight ounce packages are available at prices 15% below national brands. Look for our blue and yellow box.

This was a high information content script. Presenting many data bits facilitated recall testing, since between-group discriminations might have been blurred if a low content message was utilized. Moreover, unless testable facts were continually presented, subjects could switch attention from A to V (V to A) and then back to A (V) again without losing any A (V) information. Hence, limited perceptual capacity might obtain but not be evidenced by the testing instrument. It was crucial to ensure that if subjects switched attention from one channel to another, it was reflected in his (her) recall score.

The 42 word script was spoken at an even pace over 15 seconds, thus constituting a 168 word-per-minute speaking rate. This was moderately rapid, but technically 'slow' by Jester's [62] standards. The relative 'slowness' of presentation influenced the efficacy of completely redundant treatments, as reflected in the experimental hypotheses.

The second 15 seconds was considered irrelevant, background audio noise. Guitar music by Dwayne Eddy was chosen, since its Southern rock-and-roll style seemed compatible with the regional orientation of corn muffin products. No words were spoken or sung.

Video Track

Thirty seconds of visual (V) material was videotaped. The first 15 seconds consisted of a rapidly presented pictorial message that was contentwise compatible with the spoken auditory track. The V information consisted of 17 scenes that were videotaped from 17 photographic slides that were prepared by a professional photographer at the University of Massachusetts Photography Center. The equipment employed limited the pace at which slides were videotaped. Nevertheless, a 0.9 second/slide projection speed was attained. This is approximately the mean interchannel switching time obtained in psychology studies (see Chapter II). Hence, if the subject switched from V to A and back to V again, two scenes were probably unattended. Recall tests should reflect this altered attention focus.

The 17 visual scenes (see Appendix C) were in the following sequential order.

1. Box of Washington Brand corn muffin mix standing next to a pile of corn muffin crumbs over which is held a knife with butter on it.

2. Sandy gravel pouring out of a box of Flako corn muffin mix.

3. Box of Jiffy corn muffin mix standing in front of a tin filled with six burnt muffins.

4. Young adult female, facing the audience, with her head bent down in a look of sadness.

5. Young adult female, facing the audience, smiling, with an uplifted right arm and raised index finger, as if saying 'Ah, ha!.'

6. Box of BB Brand corn muffin mix. This was a confederate package made by taping the letters 'BB' onto an al-

tered box of corn muffin mix whose real brand name was obscured.

7. Three adjacent items: a butter dish containing one quarter pound stick of butter; three eggs in a small saucer; and one glass bowl less than half-filled with batter.

8. Table clock set at 12:00 next to a glass bowl half-filled with batter.

9. Table clock set at 12:15 next to a glass bowl three-quarters-filled with batter.

10. Jar of Grandma's Molasses held over a bowl filled with batter.

11. Glass-faced toaster-oven containing a partially visible tray of muffins.

12. Printing which says '50 MINUTES LATER.'

13. Muffin tin containing six cooked muffins, behind which is a loaf of Arnold's Naturel Bread. On each side of the bread stands an ear of corn.

14. Container of cinnamon held over a tray of cooked muffins.

15. Small plate on which stands a jar of Polaner Grape Jelly and one corn muffin with a knife, butter and jelly on top.

16. Printing which says 'REGULARLY 25¢/SERVING.'

17. Printing which says '1/2 PRICE UNTIL JUNE.'

While similar in content to the important A segment, these scenes contained different information bits. Any fact that was vocalized did not appear pictorially, and vice versa. This ensured that if attention switched from one channel to another, material in the former could not be recalled if selective attention operated. If identical information appeared at different times on A and V, recall would reveal little about selective attention processes, since one would not know which channel was being recounted.

As with the audio information track, these video scenes were high enough in content so that discriminations between individual and group recall scores were facilitated.

The second 15 seconds of the V track was considered irrelevant, background video noise. One slide of a baby eating cake was videotaped into this slot. Nothing else appeared on the screen.

Video Track Completely Redundant to the Spoken Audio

The spoken auditory script was reduced to on-screen printing by first typing it onto yellow paper with a primer typewriter. The paper and instrument employed were selected because they heightened the visual contrast between printing and background. Fifteen typed lines were required to duplicate the A message. One photographic slide was taken of each line. These slides were videotaped at the rate of one per second. Hence, the moderately rapid printing track had a 15 second duration. This material was coordinated with the announcer so that when informative audio and printing channels were together, words appeared on the screen as they were spoken. This is the definition of complete AV redundancy that is used in this dissertation.

Post-Commercial Extension of Background Material

In each videotape segment, the treatment commercial was followed by a 10 second continuation of Happy Days. This was necessary for the following reasons. There is a short term precategorical memory (iconic) of less than one second for unattended visual stimuli [4,47,65,78,87,91,114,115,130]. Unless actively attended to, these memories are not processed further and do not enter longer term memory. Similarly, there is an even longer lasting echoic memory for unattended auditory stimuli (approximately five to ten seconds if not interfered with by incoming stimuli) [19,25,43,87]. If the subject was questioned regarding the commercial immediately after its presentation, he (she) might be able to extract the material from iconic or echoic storage and bring it into active short term memory. Hence, the distinction between attended and unattended material might get blurred. The ten second delay is sufficient for all precategorical memories to decay 100%. Hence, only attended material, and not unattended stimuli, was recalled. If substantially longer delays were incorporated, then the task would have related more to memory than attention.

Procedures

Subjects were randomly assigned to six groups. Groups 1 and 2 (i.e., G1 and G2) both contained ten subjects, while 15 were in each of G3 through G6. Groups 1 and 2 were smaller since these were control groups and subjects were difficult to attract. The statistical design employed allowed for unequal cell sizes.

The experiments were conducted from 1:00 to 5:00 P.M. during Monday through Thursday of the first week in April, 1977. The specified day and time of each subject's (S') testing was via random assignment. Only one S at a time was tested, with each uninformed in advance as to the nature of the experiments. Approximately 20 minutes was required to test each S.

Questionnaires

A no time limit questionnaire (see Appendix A) was designed to test short term recall of the experimental stimuli. The objective was to ascertain the amount of spoken auditory and informative pictorial material subjects could identify. A multiple-choice format was selected. This design allowed the researcher to question subjects on each audio and video information bit. Freer-recall probes might have generated cryptic responses. Analysis of selective attention processes mandates that recognition of each audio and video projection be tested. Otherwise, a complete accounting of attended and unattended stimuli cannot be made. The research hypotheses of the current experiments necessitated such an accounting.

Subjects were instructed in writing to answer every question. If no alternative seemed appropriate, Ss circled the 'I don't remember' response.

Questions one through eight (see Appendix A) tested recallability of the spoken auditory track. Identification was sought for virtually every word in the aural script. In questions one, two 'a,' three, four and seven, Ss were instructed to designate one answer only from among six multiple choices. For queries two 'b,' five, six and eight, one or more out of nine possibilities was to be circled. The latter form was only employed to test recall of multi-adjectived clauses (e.g., dry, crumbling, unsweet cakes). A single question was used for each of these clauses. However, in responding, subjects were asked to identify separately each adjective without being told how many adjectives to designate (i.e., the only instruction was to circle one or more answers). Hence, subjects were given minimal cues upon which to base their answers. The maximum audio score was 15.

Questions nine through twenty-two tested recallability of the informative pictorial message. Identification was sought for virtually every item in each of the 17 scenes that appeared on the television monitor. In questions 14, 15, 20, 21 and 22, subjects were instructed to designate one answer only from among six multiple choices. For items 9 through 13 and 16 through 19, one or more out of nine possibilities was to be circled. Single choice formats were used to ascertain if Ss recalled the on-screen printing segments of the pictorial message. Otherwise, there was no systematic difference between the information tested by one-answer-only and by one-or-more-answer designs. These alternative question types were used to obscure the number of responses sought. Hence, subjects were given minimal cues upon which to base their answers. The maximum video score was 28.

A short debriefing questionnaire was also constructed (see Appendix B). Its purpose was to reveal demand artifacts which might alternatively explain the experimental results. Short answer questions covering the following topics were utilized: subjects' speculations on the true nature of the experiments; the level of prior information about both the experiments themselves and the products used in the commercials; and perceived differences between subjects' normal television viewing behavior and that experienced during the experimental treatments.

Data Collection

The experimental setting was a soundproof, windowless office that contained the following relevant equipment: one 21" black and white television monitor; one comfortable swivel chair; one desk; two hardback wooden chairs; and thermostat and light control switches.

The swivel seat was placed seven feet in front of the television monitor. In pretesting, this was deemed a comfortable viewing distance. Adjacent to the monitor was a desk and chair at which subjects filled out the experimental questionnaire. Ten feet behind the monitor was a hardback chair at which the experimenter (E) sat while Ss viewed the test commercial. This chair was positioned so subjects could not see E during the television presentation. The thermostat was fixed at 68 degrees Fahrenheit throughout the testing period. Otherwise, temperature variations could have influenced recall. Likewise, volume, brightness and contrast levels on the monitor were identical across all treatments.

Subjects waited in a reception area until summoned by E, who silently ushered them into the experimental setting. Once the door was closed, E asked S to sit down in the swivel chair and get comfortable. The following instructions were then rendered verbally: "You are going to watch a segment from a well-known television program. Please watch it. Afterwards, there will be a short, uncomplicated task for you to perform." Next, the monitor was activated by E, who then turned off the light switch and retired to the chair that shielded him from S' view. At this juncture, the only item visible to S was the lighted television screen. The monitor also provided all auditory stimuli in the room.

The videotape presentations lasted two minutes. The first 80 seconds of each contained the introduction to Happy Days (a popular situation comedy). This segment was intended to relax Ss and to get them into their normal viewing posture. Because Ss knew they were participating in an experiment, higher than usual concentration levels were expected. The hypotheses incorporate this anticipated concentration profile.

The Happy Days showing was followed by a 30 second commercial, of which there were six variations. These advertisements were assigned randomly to the six groups, with all the members of each group being exposed to one treatment only. At the commercial's end, a ten second continuation of Happy Days was shown. When the post-commercial clip ended, E stood up, turned on the lights and turned off the monitor. Then, S was asked to stand up and walk over to the desk, on top of which lay the experimental questionnaire. S was asked to please sit down and complete the form with the provided ball point pen. No time limit was designated. E then left the room to avoid disturbing S. E returned ten minutes later to pick up the questionnaire and administer a short debriefing form. While S responded as directed, E graded the questionnaire. If incomplete answers or other irregularities obtained, S was asked to repair the deficiencies. Upon completion of the post-experimental debriefing, subjects were thanked, briefly informed about the true nature of the experiment, and asked not to discuss the study with other subjects. The identical procedure was then repeated on a new S.

Summary

The six experiments outlined in Chapter III address several applied issues relating to selective attention processes. Specifically, hypotheses one, two and three concern whether perceptual interference exists between relevant A and relevant V channels in television commercials. These hypotheses also address whether attention to each remaining channel increases as the total number of channels projected decreases. Hypothesis 4 examines the relationship between primary-channel recall and information content within secondary channels. Hypothesis 5 assumes that the presentation speed and task structure in these experiments are not conditions under which complete AV redundancy will enhance recall. Hypothesis 6 addresses whether different perceptual levels result from multiple versus single-channel presentations of television advertisements. Strategy implications are discussed in Chapter V. Taken together, the six experimental hypotheses explore whether advertising copy can be designed to direct the viewer's attention to specific information presented.

CHAPTER IV

RESULTS AND ANALYSIS

Preliminary Procedures

Each questionnaire was graded while each subject completed a short debriefing form. If any test question was unanswered or some irregularity obtained, the subject was asked to correct his (her) answer sheet. This procedure eliminated non-responses and undecipherable answers. Out of eighty cases, only three had to be returned for corrections. This small number of improper responses indicated that subjects understood the written instructions and were sufficiently involved so that they complied with them. Regarding the three maladaptive cases, one subject left two and another subject left three questions unanswered. The third subject circled two answers on each of two questions requiring the selection of one answer only. These deficiencies were easily repaired. Hence, no data were deleted due to testing errors.

The responses to certain debriefing questions were reviewed to ascertain if any data need be discarded because of demand artifacts. Subjects were asked to indicate what they thought was the experiment's objective. Responses varied and included speculations concerning the effectiveness of different types of advertisements, the degree of attention paid to commercials, and the retention of information presented in advertisements. No subject identified the true purpose of the study.

Another debriefing question explored the extent of prior information about products shown in the test commercial. Thirty-one subjects indicated familiarity with Jiffy Brand corn muffins. Three subjects reported knowledge of Arnold's Naturel Bread. This also occurred with Polaner Grape Jelly. Two subjects named Flako corn muffins and one referenced Washington Brand. Hence, except for Jiffy, subjects were basically unfamiliar with the products depicted. Unfamiliarity with products was desired to control for respondent bias due to unequal prior information. Concerning Jiffy, the comparative number of correct responses was not directly related to differences in the number of subjects reporting familiarity with Jiffy (e.g., 13 out of 15 subjects in treatment four correctly identified Jiffy while 12 out of 15 subjects in treatment five did, even though six treatment four subjects as compared to nine treatment five subjects had prior knowledge).

Subjects were also asked to indicate whether they had talked about the experiment with any former participant. All subjects answered in the negative. Another debriefing question sought to ascertain whether subjects viewed the test commercial in a manner substantially different from their ordinary television viewing. Most subjects indicated they concentrated more intently while watching the experimental presentation than they ordinarily did while watching in-home broadcasts. Hence, an active as opposed to passive learning situation obtained. The converse usually exists in normal television commercial viewing. Except for treatment group six, the fact that active learning took place probably generated higher overall recall scores than would have occurred under more natural viewing conditions. However, there is no theoretical basis for expecting this influence to differ across treatment groups. Hence, intergroup comparisons should not be affected. Concerning treatment six, whether the situation involves passive or active learning qualitatively affects the results of redundancy manipulations. In Chapter III, the hypotheses involving treatment six reflected these considerations.

The analysis of debriefing responses thus failed to uncover fallacious data. Hence, the scores from all eighty subjects were utilized.

Computing the Response Measures

Short-term recall was used as a surrogate measure of attention. If information was recalled, it was either attended or chosen by fortuitous guessing. Material not recalled may or may not have been attended. That is, incorrect recounting of attended stimuli could have obtained because the individual was unable to extract the information from memory storage. To the extent that memory failures occurred, attention levels were underestimated. Hence, the stimuli that Ss recalled was actually less than or equal to the stimuli attended.

The six response variables used in this study follow.

1. Number of correct responses to audio-related questions (A). There were eight multiple choice queries that dealt with the auditory track. These appear as questions one through eight in Appendix A. Some questions (i.e., two, five, six and eight) allowed more than one response choice. Hence, a maximum of 15 correct A answers was possible. In grading, all correct responses were counted, even if erroneous items were also circled. The A score for each subject ranged from zero to 15.

2. Number of correct responses to video-related questions (V). There were 14 multiple choice queries that dealt with the video track. These appear as questions nine through twenty-two in Appendix A. Some questions (i.e., nine through thirteen and sixteen through nineteen) allowed more than one response choice. Hence, a maximum of 28 correct V answers was possible. In grading, all correct responses were counted, even if erroneous items were also circled. The V score for each subject ranged from zero to 28.

3. Number of correct answers to audio-related ques-

tions divided by 15 (i.e., the total number of possible correct audio responses) plus the number of correct answers to video-related questions divided by 28 (i.e., the total number of possible correct video responses) (C).

This variable (C) was the sum of the normalized A and V scores on questions one through twenty-two in Appendix A. Since there were more video than audio questions, summing the raw data (i.e., A+V) would have lent greater relative weight to the video. By normalizing A and V, this imbalance was corrected, since C represented the proportion of audio plus the proportion of video questions correctly answered.

4. Number of correct and erroneous responses to audio-related questions (A+Aw). Erroneous responses included all incorrect answers except for 'I don't remember' designations. The reason for including incorrect results is that errors were postulated to represent partial cognitions about the experimental stimuli. That is, the material was probably attended but not accurately extracted from longer term memory. Only certain features were recalled, but not all. Hence, on the questionnaire, subjects might have confused similar stimuli (e.g., some people erroneously reported hearing Maxwell's Brand instead of Baxter's Brand). Since the current study attempted to ascertain attention levels, and since errors were classified as attended, but incorrectly recalled information, summing correct and erroneous responses to generate an audio attention level score seemed

appropriate.

5. Number of correct and erroneous responses to video-related questions (V+Vw). Erroneous responses included all incorrect answers except for 'I don't remember' designations. The reasons for including errors were identical to those outlined in the discussion of A+Aw above.

6. Number of correct and erroneous answers to audio-related questions divided by the total number of possible correct audio responses (i.e., 15), plus the number of correct and erroneous answers to video-related questions divided by the total number of possible correct video responses (i.e., 28) (D). Variable (D) normalized the A+Aw and V+Vw scores before adding them together. Normalization equalized the weighting of audio and video in generating an overall attention measure.

Computations on the data were made using the University of Massachusetts Computer Center version of the Biomedical Computer Programs text [52]. For variables A, V, A+Aw, V+Vw, C and D, sample arithmetic means and variances were computed for each experimental group. These results are shown in Tables 4.1 and 4.2.

Tests of Hypotheses: t-Tests

To test the research hypotheses, comparisons of group means and variances on each of the six response variables were undertaken. The multiple sample means for each treat-

LEDGER FOR TABLES 4.1 THROUGH 4.11

The following notation is used in Tables 4.1 through 4.11:

A is number of correct responses to audio-related questions (maximum=15);

V is number of correct responses to video-related questions (maximum=28);

C is number of correct responses to audio-related questions divided by the total number of possible correct audio responses plus the number of correct video responses divided by the total number of possible correct video responses;

$A+A_W$ is the number of correct and erroneous responses to audio-related questions;

$V+V_W$ is the number of correct and erroneous responses to video-related questions;

D is the number of correct and erroneous responses to audio-related questions divided by the total number of possible correct audio responses plus the number of correct and erroneous responses to video-related questions divided by the total number of possible correct video responses;

N is the number of subjects;

P are one-tailed significance levels for F-tests (Tables 4.2 and 4.11) and for univariate t-Tests calculated with separate (not pooled) variances (Tables 4.5 through 4.10); and

n.s. is 'not significant.'

TABLE 4.1

GROUP MEAN RESPONSE SCORES FOR EACH EXPERIMENTAL VARIABLE

GROUP \ VARIABLE	A	V	C	A+Aw	V+Vw	D
1[a]	6.20	---[c]	0.41	8.20	---[c]	0.41
2[a]	---[d]	6.90	0.25	---[d]	10.20	0.25
3[b]	4.00	4.33	0.45	5.93	7.00	0.65
4[b]	4.07	6.60	0.52	6.67	8.20	0.74
5[b]	6.40	8.67	0.74	8.80	12.07	1.02
6[b]	5.33	6.13	0.58	7.40	8.60	0.80

[a] N=10.

[b] N=15.

[c] Group 1 did not receive any video information.

[d] Group 2 did not receive any audio information.

TABLE 4.2

VARIANCES WITHIN TREATMENT GROUPS FOR EACH EXPERIMENTAL VARIABLE[a]

GROUP \ VARIABLE	A	V	C	A+Aw	V+Vw	D
1[b]	6.60	---[d]	.03	9.99	---[d]	.03
2[b]	---[e]	4.75	.01	---[e]	12.18	.01
3[c]	8.41	6.25	.07	14.67	23.33	.14
4[c]	5.62	9.67	.04	12.67	12.32	.10
5[c]	3.39	14.52	.06	9.30	31.02	.14
6[c]	2.96	5.43	.02	7.13	13.69	.07

[a]Table values represent sample variances (i.e., s^2).

[b]N=10.

[c]N=15.

[d]Group 1 did not receive any video information.

[e]Group 2 did not receive any audio information.

ment group were first clustered into appropriate subsets. Groups three through six received both audio and video information tracks. Hence, simultaneous comparisons between pairs of these groups across both overall-recall variables (i.e., the subset (C,D)) were made via Hotelling T^2 tests. When more than one sample mean is calculated for each treatment group, to ascertain the existence of significant differences between two groups requires null hypotheses for all response variables to be tested simultaneously. Repeated application of simple univariate t-tests will not indicate the simultaneous level of significance at which the null hypotheses concerning vectors of means are rejected.

Therefore, data were evaluated by the multivariate technique of Hotelling T^2 analysis. The analysis tests for significant differences between p-mean responses of two independent groups which have been administered the same p-stimuli but under different treatment conditions. It utilizes the Hotelling T^2-distribution which is a multivariate extension of Student's t to multiple criterion measures. Conventionally, T^2-statistics are transformed to F values, with tests of significance employing the latter distribution. Assumptions underlying the testing are that observations in each group are independently normally distributed, and that the variance matrix Σ is non-singular.

In the present context, Hotelling T^2 analysis required that mean score vectors (μ) be constructed for each treatment group. Vector elements were average scores of the respective group on the given response variables. Then, two-sample T^2-statistics across pairs of treatment groups were calculated to examine the hypothesis that the population vectors were equal. The null hypothesis is

$$H_0: (\mu_{i1}, \mu_{i2}, \ldots, \mu_{ip}) = (\mu_{j1}, \mu_{j2}, \ldots, \mu_{jp})$$

where $i \neq j$ (group designations) and p is the number of response variables tested. The alternative hypothesis is that the two vectors are not equal for one or more elements in a predetermined direction.

Assume that $\overline{X}_1$ and $\overline{X}_2$ are the (1xp) sample mean vectors for two groups, based on N_1 and N_2 observations, respectively. $\overline{X}$ is 2xp, with row vectors $\overline{X}_1'$ and $\overline{X}_2'$. The sample covariance matrix for the two groups is

$$\hat{\Sigma} = \frac{1}{N_1+N_2-2} [\overline{X}_1'\overline{X}_1 + \overline{X}_2'\overline{X}_2] \tag{4.1}$$

The test statistic is

$$T^2 = \frac{N_1 N_2}{N_1+N_2} [\overline{X}_1 - \overline{X}_2]^1 \hat{\Sigma}^{-1} [\overline{X}_1 - \overline{X}_2] \tag{4.2}$$

which can be transformed to F distribution values by

$$F(p, N_1+N_2-p-1) = \frac{(N_1+N_2-p-1) \cdot T^2}{P \cdot (N_1+N_2-2)} \tag{4.3}$$

where p is the number of response variables. In the above equations, population parameters (μ, Σ) have been replaced with their respective sample estimates $(\overline{X}, \hat{\Sigma})$.

For those two-sample comparisons where the null hypothesis was rejected at the .10 level (one-tailed), preplanned univariate t-tests were employed to indicate which variable(s) accounted for the significant intergroup differences.

The fairly large .10 significance level was chosen because: (i) falsely rejecting the null hypotheses was not likely to generate many adverse consequences for advertising management. Hence, a fairly large error rate was tolerable; (ii) Labovitz [73] suggests using large error rates when small sample sizes are employed; (iii) the experimental postulates were consistent with existing psychological and communications research theory; (iv) the author wanted to avoid not rejecting a false null hypothesis (type II error). Such errors are less likely, the higher the significance level; (v) the experimental design substantially controlled the effects of extraneous factors. Stringent controls reduced alternative explanations for the results obtained, thus rendering a larger significance level more tolerable; (vi) the researcher was confident as to the direction of hypothesized intergroup score differences; and (vii) the T^2 calculations were exploratory, with the primary focus upon intergroup comparisons on single variables. These univariate tests employed the t-statistic. All t-value significance levels less than .10 are reported and discussed, as justified by criteria (i) through (vi) above.

The usual Hotelling T^2 and t-test assumptions are:

(1) for each treatment population, the distribution of response variable scores is normal; and (2) the two groups are independent and sampling is random. The second assumption was met since each subject was assigned to one treatment group, with membership based on random assignment. As to minimizing departures from normality, making group sizes large and equal is recommended. Groups three through six each contained 15 members, while groups one and two consisted of ten subjects each. Being moderate in size, these were not ideal with respect to normality consideration. However, since t is definitely and T^2 is probably not overly sensitive to departures from normality [131], the criteria seemed sufficiently satisfied.

An additional assumption of t and T^2 is that the variance within each treatment group is assumed to be the same (i.e., there is homogeneity of variance). As indicated in Chapter III, heterogeneous variance across treatment groups was expected. For populations with unequal variances, t-values for the differences in sample means cannot be computed. Instead, approximations to t-tests are calculated using separate variance estimates for each group as opposed to pooled variances. Since there is little loss in accuracy from using the separate variance t even when the pooled t may be appropriate, and since the error from using the pooled t when variances are not equal can be very serious, the calculations below are separate variance t-values.

The appropriate test statistic is

$$t(N_i+N_j-2) = \frac{\overline{X}_i-\overline{X}_j}{\sqrt{\frac{s_i^2}{N_i}+\frac{s_j^2}{N_j}}} \tag{4.4}$$

where s_k^2 are respective sample variances, and N_k are respective cell sizes.

In addition to the subset (C,D), all pairs among groups three through six were also simultaneously compared across all audio and video variables (i.e., the subset (A,V,A+Aw,V+Vw) using Hotelling T^2-statistics. Similarly, all pairs among groups one, three, four, five and six were compared simultaneously across all audio variables (i.e., the subset (A,A+Aw)), while all pairs among groups two through six were compared simultaneously across all video variables (i.e., the subset (V,V+Vw)). The former groups encompassed all subjects receiving the audio information track, while the latter groups included all those receiving the important video material. As above, for those comparisons where the null hypothesis was rejected at the .10 level (one-tailed), univariate t-tests ascertained which variable(s) accounted for the significant difference between groups.

Hypothesis 6 was tested by comparing within group variances across treatment groups. One-tailed F-tests were used, since the experimenter wanted to ascertain if the variance within one group was larger than that in another. F-test assumptions are the same as assumptions (i) and (ii) above. As indicated, these were sufficiently met.

Hypothesis 1

Hypothesis 1 states that audio recall will be higher among Group 1 subjects than among those in Groups 3, 4, and 6. That is, if audio information is presented without background video (i.e., the screen is blank), more audio material will be attended than if the audio track appears simultaneously with moving background (Group 3), stationary background (Group 4), or even completely redundant video (Group 6).

Two audio-related variables were calculated: A and A+Aw. The set of multivariate hypotheses to be tested is:

a) $H_0: (\mu_{1A}, \mu_{1(A+Aw)}) = (\mu_{3A}, \mu_{3(A+Aw)})$

$H_1: (\mu_{1A}, \mu_{1(A+Aw)}) > (\mu_{3A}, \mu_{3(A+Aw)})$

b) $H_0: (\mu_{1A}, \mu_{1(A+Aw)}) = (\mu_{4A}, \mu_{4(A+Aw)})$

$H_1: (\mu_{1A}, \mu_{1(A+Aw)}) > (\mu_{4A}, \mu_{4(A+Aw)})$

c) $H_0: (\mu_{1A}, \mu_{1(A+Aw)}) = (\mu_{6A}, \mu_{6(A+Aw)})$

$H_1: (\mu_{1A}, \mu_{1(A+Aw)}) > (\mu_{6A}, \mu_{6(A+Aw)})$

Note that in all cases the first subscript refers to the specific treatment group under consideration and the second subscript refers to the response variable. This format will obtain throughout the discussion of experimental hypotheses. As shown in Table 4.3, the first null hypothesis was weakly rejected. That is, the Hotelling T^2 had an F value which was significant at $p \leq .09$ (one-tailed). The second null hypothesis was also rejected ($p < .05$, one-tailed). The third null hypothesis was not ($p > .10$, one-tailed), but the difference between groups was in the direction postulated.

<u>Univariate Tests</u>. Since the first two alternative hypotheses were accepted, the next step was to ascertain which variable(s) among the subset (A,A+Aw) accounted for the significant differences between Groups (1,3) and (1,4), respectively. Referring to Tables 4.4 and 4.5, Groups 1 and 3 were compared first. Hence, two separate univariate hypotheses were tested:

a) $H_0: \mu_{1A} = \mu_{3A}$

$H_1: \mu_{1A} > \mu_{3A}$

b) $H_0: \mu_{1(A+Aw)} = \mu_{3(A+Aw)}$

$H_1: \mu_{1(A+Aw)} > \mu_{3(A+Aw)}$

Both null hypotheses were rejected, the former at $p < .05$ (one-tailed) and the latter at $p < .10$ (one-tailed). Since greater significance obtained when A was used, including errors failed to enhance the results. It was expected that more errors would be evidenced in Group 1 than in Group 3. While this was true in absolute terms, errors contributed propor-

TABLE 4.3

SIMULTANEOUS COMPARISON OF GROUP PAIRS ON VECTORS OF RESPONSE VARIABLES

GROUPS COMPARED	HOTELLINGS T^2 FOR VECTOR I[a]	F	df	p^c	HOTELLINGS T^2 FOR VECTOR II[b]	F	df	p^c
1,3	3.98	1.90	2,22	.09	---	---	---	---
1,4	5.60	2.68	2,22	.05	---	---	---	---
1,5	0.37	0.18	2,22	n.s.	---	---	---	---
1,6	1.09	0.52	2,22	n.s.	---	---	---	---
2,3	---	---	---	---	7.42	3.55	2,22	.02
2,4	---	---	---	---	5.57	2.66	2,22	.05
2,5	---	---	---	---	2.06	0.99	2,22	n.s.
2,6	---	---	---	---	1.20	0.57	2,22	n.s.

[a]Vector I includes the variable subset {A,A+Aw}.

[b]Vector II inclues the variable subset {V,V+Vw}.

[c]One-tailed significance level for indicated df.

TABLE 4.4

DIFFERENCES BETWEEN MEAN RESPONSE SCORES OF TREATMENT GROUPS ON VARIABLE A[a]

GROUP i / GROUP j	1[b]	3[c]	4[c]	5[c]	6[c]
1[b]					
3[c]	-2.20[f]				
4[c]	-2.13[e]	0.07			
5[c]	0.20	2.40[d]	2.34[d]		
6[c]	-0.87	1.33[g]	1.26[f]	-1.07[g]	

[a]Table values denote Group j mean score on variable A minus Group i mean score on variable A.

[b]N=10.

[c]N=15.

[d]p<.01.

[e]p<.025.

[f]p<.05.

[g]p<.10.

TABLE 4.5

DIFFERENCES BETWEEN MEAN RESPONSE SCORES OF TREATMENT GROUPS ON VARIABLE A+Aw[a]

GROUP i / GROUP j	1[b]	3[c]	4[c]	5[c]	6[c]
1[b]					
3[c]	-2.27[f]				
4[c]	-1.53	0.74			
5[c]	0.60	2.87[d]	2.13[e]		
6[c]	-0.80	1.47	0.73	1.40[f]	

[a]Table values denote Group j mean score on variable A+Aw minus Group i mean score on variable A+Aw.

[b]N=10.

[c]N=15.

[d]$p<.025$.

[e]$p<.05$.

[f]$p<.10$.

tionally more to A+Aw in Group 3 than in Group 1. This accounted for the drop in significance level when Aw was added onto A.

Comparing Groups 1 and 4, this error effect was even stronger. The appropriate set of univariate hypotheses is:

a) $H_0: \mu_{1A} = \mu_{4A}$

$H_1: \mu_{1A} > \mu_{4A}$

b) $H_0: \mu_{1(A+Aw)} = \mu_{4(A+Aw)}$

$H_1: \mu_{1(A+Aw)} > \mu_{4(A+Aw)}$

The first null hypothesis was rejected at $p<.025$ (one-tailed), but the second was not ($p>.10$). Hence, correct audio recall was significantly higher in Group 1 than in Group 3. However, when errors were included, the difference was in the direction indicated but it was not significant at $p<.10$.

In summary, Hypothesis 1 was significantly supported when Group 1 was compared with Groups 3 and 4. The hypothesized difference between Groups 1 and 6 was directionally, but nonsignificantly, supported.

Hypothesis 2

Hypothesis 2 states that video recall will be higher among Group 2 subjects than among those in Groups 3 and 4. That is, if video information is shown without background audio (i.e., no sound), more video will be attended than if it is projected concurrent with an audio track. Regardless of whether the audio is high (Group 3) or low (Group 4) in information content, the video-only treatment should generate higher recall.

Two video-related variables were calculated: V and V+Vw. The set of multivariate hypotheses to be tested is:

a) $H_0: (\mu_{2V}, \mu_{2(V+Vw)}) = (\mu_{3V}, \mu_{3(V+Vw)})$

$H_1: (\mu_{2V}, \mu_{2(V+Vw)}) > (\mu_{3V}, \mu_{3(V+Vw)})$

b) $H_0: (\mu_{2V}, \mu_{2(V+Vw)}) = (\mu_{4V}, \mu_{4(V+Vw)})$

$H_1: (\mu_{2V}, \mu_{2(V+Vw)}) > (\mu_{4V}, \mu_{4(V+Vw)})$

As shown in Table 4.3, the first null hypothesis was rejected at $p<.02$ (one-tailed), while the second was rejected at $p<.05$ (one-tailed).

<u>Univariate tests</u>. Since both alternative hypotheses were accepted, the next step was to ascertain which variable(s) among the subset (V,V+Vw) accounted for the significant differences between groups. Referring to Tables 4.6 and 4.7, Groups 2 and 3 were compared. Two separate univariate hypotheses were tested:

a) $H_0: \mu_{2V} = \mu_{3V}$

$H_1: \mu_{2V} > \mu_{3V}$

b) $H_0: \mu_{2(V+Vw)} = \mu_{3(V+Vw)}$

$H_1: \mu_{2(V+Vw)} > \mu_{3(V+Vw)}$

TABLE 4.6

DIFFERENCES BETWEEN MEAN RESPONSE SCORES OF TREATMENT GROUPS ON VARIABLE V[a]

GROUP j \ GROUP i	2[b]	3[c]	4[c]	5[c]	6[c]
2[b]					
3[c]	-2.57[d]				
4[c]	-0.30	2.27[e]			
5[c]	1.77[f]	4.34[d]	2.07[f]		
6[c]	-0.77	1.81[e]	-0.47	-2.54[e]	

[a]Table values denote Group j mean score on variable V minus Group i mean score on variable V.

[b]N=10.

[c]N=15.

[d]$p<.01$.

[e]$p<.025$.

[f]$p<.10$.

TABLE 4.7

DIFFERENCES BETWEEN MEAN RESPONSE SCORES OF TREATMENT GROUPS ON VARIABLE V+Vw[a]

GROUP j \ GROUP i	2[b]	3[c]	4[c]	5[c]	6[c]
2[b]					
3[c]	-3.20[f]				
4[c]	-2.00[g]	1.20			
5[c]	1.87	5.07[d]	3.87[e]		
6[c]	-1.60	1.60	0.40	-3.47[f]	

[a]Table values denote Group j mean score on variable V+Vw minus Group i mean score on variable V+Vw.

[b]N=10.

[c]N=15.

[d]$p<.01$.

[e]$p<.025$.

[f]$p<.05$.

[g]$p<.10$.

Both null hypotheses were rejected, the former at $p<.01$ (one-tailed), and the latter at $p<.05$ (one-tailed). As with the audio-related treatments, adding errors onto correct video scores decreased the significance level. This implies more errors were of the fallacious rather than the partial recall type, with the former more prevalent in the audio-video treatments than in video-only.

Comparing Groups 2 and 4, the appropriate set of univariate hypotheses is:

a) $H_0: \mu_{2V} = \mu_{4V}$

$H_1: \mu_{2V} > \mu_{4V}$

b) $H_0: \mu_{2(V+Vw)} = \mu_{4(V+Vw)}$

$H_1: \mu_{2(V+Vw)} > \mu_{4(V+Vw)}$

The first null hypothesis was not rejected ($p>.10$, one-tailed). However, mean video scores for Group 2 subjects were higher than those of Group 4. The second null hypothesis was rejected at $p<.10$ (one-tailed). Hence, including erroneous responses magnified the between-group difference. This was consistent with the interpretation of errors as partial recalls.

In summary, the hypothesized superiority of Group 2 over Group 3 with respect to video recall was supported. The hypotheses concerning Groups 2 and 4 were only partially verified. All results were in the direction postulated, but significance levels of $p<.10$ (one-tailed) obtained only with V+Vw, and not with V as the recall variable.

Hypothesis 3

Hypothesis 3 states that total recall will be higher among Group 5 subjects than among those in Groups 3 and 4. That is, if audio and video information are disjoint (Group 5), recall of both will be higher than if either audio and video information are shown simultaneously (Group 3), or if audio material is presented concurrent with stationary background video and then video information is shown simultaneously with background audio (Group 4). These postulates assume perceptual limitations prevent us from attending more than one stimulus track at a time. From the viewer's perspective, this implies audio (video) stimuli interfere with recall of video (audio) stimuli in television commercials.

Two total-recall variables were calculated: C and D. The set of multivariate hypotheses to be tested are:

a) $H_0: (\mu_{5C}, \mu_{5D}) = (\mu_{3C}, \mu_{3D})$

$H_1: (\mu_{5C}, \mu_{5D}) > (\mu_{3C}, \mu_{3D})$

b) $H_0: (\mu_{5C}, \mu_{5D}) = (\mu_{4C}, \mu_{4D})$

$H_1: (\mu_{5C}, \mu_{5D}) > (\mu_{4C}, \mu_{4D})$

As shown in Table 4.8, the first null hypothesis was rejected at $p<.01$ (one-tailed), while the second was rejected at

TABLE 4.8

SIMULTANEOUS COMPARISON OF GROUP PAIRS ON VECTORS OF RESPONSE VARIABLES

GROUPS COMPARED	HOTELLINGS T^2 FOR VECTOR I[a]	F	df	p^c	HOTELLINGS T^2 FOR VECTOR II[b]	F	df	p^c
3,4	0.62	0.30	2,27	n.s.	9.96	2.22	4,25	.05
3,5	9.60	4.62	2,27	.01	16.72	3.73	4,25	.01
3,6	2.72	1.31	2,27	n.s.	8.98	2.00	4,25	.06
4,5	7.50	3.62	2,27	.02	15.45	3.45	4,25	.01
4,6	1.07	0.51	2,27	n.s.	5.82	1.30	4,25	n.s.
5,6	5.24	2.53	2,27	.05	5.72	1.28	4,25	n.s.

[a] Vector I includes the variable subset {C,D}.

[b] Vector II includes the variable subset {A,V,A+Aw,V+Vw}.

[c] One-tailed significance level for indicated df.

$p<.02$ (one-tailed).

Univariate tests. Since both alternative hypotheses were accepted, the next step was to ascertain which variable(s) among the subset (C,D) accounted for the significant differences between groups. Referring to Tables 4.9 and 4.10, Groups 5 and 3 were compared first. Two separate univariate hypotheses were tested:

a) $H_0: \mu_{5C} = \mu_{3C}$

$H_1: \mu_{5C} > \mu_{3C}$

b) $H_0: \mu_{5D} = \mu_{3D}$

$H_1: \mu_{5D} > \mu_{3D}$

Both null hypotheses were rejected at $p<.01$ (one-tailed). Hence, Group 5 secured markedly higher total-recall scores than did Group 3, regardless of whether errors were included or not.

Similar results obtained when Groups 5 and 4 were compared. The salient univariate hypotheses are:

a) $H_0: \mu_{5C} = \mu_{4C}$

$H_1: \mu_{5C} > \mu_{4C}$

b) $H_0: \mu_{5D} = \mu_{4C}$

$H_1: \mu_{5D} > \mu_{4C}$

The first null hypothesis was rejected at $p<.01$ (one-tailed),

TABLE 4.9

DIFFERENCES BETWEEN MEAN RESPONSE SCORES OF TREATMENT GROUPS ON VARIABLE C[a]

GROUP j \ GROUP i	3[b]	4[b]	5[b]	6[b]
3[b]				
4[b]	0.07			
5[b]	0.29[c]	0.22[c]		
6[b]	0.13[e]	0.06	-0.16[d]	

[a]Table values denote Group j mean score on variable C minus Group i mean score on variable C.

[b]$N=15$.

[c]$p<.01$.

[d]$p<.025$.

[e]$p<.10$.

TABLE 4.10

DIFFERENCES BETWEEN MEAN RESPONSE SCORES OF TREATMENT GROUPS ON VARIABLE D[a]

GROUP j \ GROUP i	3[b]	4[b]	5[b]	6[b]
3[b]				
4[b]	0.09			
5[b]	0.37[c]	0.28[d]		
6[b]	0.15[f]	0.06	-0.22[e]	

[a]Table values denote Group j mean score on variable D minus Group i mean score on variable D.

[b]N=15.

[c]$p<.01$.

[d]$p<.025$.

[e]$p<.05$.

[f]$p<.10$.

while the second was rejected at $p<.025$ (one-tailed). Once again, including errors had a slight dampening effect upon significance levels.

Multivariate tests. Having verified the relative superiority of Group 5 on both total-recall measures, comparisons based upon the separate audio and video variables were conducted. Four such variables had been calculated: A, V, A+Aw, and V+Vw. The set of multivariate hypotheses to be tested are:

a) $H_0: (\mu_{5A}, \mu_{5V}, \mu_{5(A+Aw)}, \mu_{5(V+Vw)})$

$$= (\mu_{3A}, \mu_{3V}, \mu_{3(A+Aw)}, \mu_{3(V+Vw)})$$

$H_1: (\mu_{5A}, \mu_{5V}, \mu_{5(A+Aw)}, \mu_{5(V+Vw)})$

$$> (\mu_{3A}, \mu_{3V}, \mu_{3(A+Aw)}, \mu_{3(V+Vw)})$$

b) $H_0: (\mu_{5A}, \mu_{5V}, \mu_{5(A+Aw)}, \mu_{5(V+Vw)})$

$$= (\mu_{4A}, \mu_{4V}, \mu_{4(A+Aw)}, \mu_{4(V+Vw)})$$

$H_1: (\mu_{5A}, \mu_{5V}, \mu_{5(A+Aw)}, \mu_{5(V+Vw)})$

$$> (\mu_{4A}, \mu_{4V}, \mu_{4(A+Aw)}, \mu_{4(V+Vw)})$$

As shown in Table 4.8, both null hypotheses were rejected at $p<.01$ (one-tailed).

Univariate tests. Since both alternative hypotheses were accepted, the next step was to ascertain which variable(s) among the subset (A,V,A+Aw,V+Vw) accounted for the significant differences between groups. Referring to Tables 4.4 through 4.7, Groups 5 and 3 were compared. The appropriate univariate hypotheses are:

a) $H_0: \mu_{5A} = \mu_{3A}$

$H_1: \mu_{5A} > \mu_{3A}$

b) $H_0: \mu_{5V} = \mu_{3V}$

$H_1: \mu_{5V} > \mu_{3V}$

c) $H_0: \mu_{5(A+Aw)} = \mu_{3(A+Aw)}$

$H_1: \mu_{5(A+Aw)} > \mu_{3(A+Aw)}$

d) $H_0: \mu_{5(V+Vw)} = \mu_{3(V+Vw)}$

$H_1: \mu_{5(V+Vw)} > \mu_{3(V+Vw)}$

The first, second and fourth null hypotheses were rejected at $p<.01$ (one-tailed), while the third was rejected at $p<.025$ (one-tailed). Hence, all four of the alternative hypotheses were accepted. Thus, Group 5 was superior to Group 3 on all audio and video variables (both including and excluding errors).

Comparing Groups 5 and 4, the following univariate hypotheses were tested:

a) $H_0: \mu_{5A} = \mu_{4A}$

$H_1: \mu_{5A} > \mu_{4A}$

b) $H_0: \mu_{5V} = \mu_{3V}$

$H_1: \mu_{5V} > \mu_{3V}$

c) $H_0: \mu_{5(A+Aw)} = \mu_{3(A+Aw)}$

$H_1: \mu_{5(A+Aw)} > \mu_{3(A+Aw)}$

d) $H_0: \mu_{5(V+Vw)} = \mu_{3(V+Vw)}$

$H_1: \mu_{5(V+Vw)} > \mu_{3(V+Vw)}$

The first null hypothesis was rejected at $p<.01$ (one-tailed), the second at $p<.10$ (one-tailed), the third at $p<.05$ (one-tailed), and the fourth at $p<.025$ (one-tailed). Hence, all four alternative hypotheses were accepted. The inclusion of errors produced variable effects. With respect to audio recall, a higher significance level was attained when errors were not included, but the converse obtained for video recall.

In summary, Group 5 scores on each of the six response variables were significantly higher than those of Groups 3 and 4. Hence, Hypothesis 3 was strongly supported.

<u>Hypothesis 4</u>

Hypothesis 4 states that total recall will be higher among Group 4 subjects than among those in Group 3. That is, if audio information is presented simultaneously with stationary background video (Group 4), recall will be higher than if audio and video information are shown simultaneously (Group 3).

This assumes that when information is projected on one stimulus channel, cognitive interference will be positively related to the information level in the secondary channel. The higher the stimulus value of this secondary channel, the more likely the viewer is to attend it, thus cognitively switching away from the primary one. Given people's limited attention capacity, this will dampen assimilation and, hence, recall of information in the primary channel.

Two total-recall variables were calculated: C and D. The multivariate hypothesis to be tested is:

$$H_0: (\mu_{4C}, \mu_{4D}) = (\mu_{3C}, \mu_{3D})$$

$$H_1: (\mu_{4C}, \mu_{4D}) > (\mu_{3C}, \mu_{3D})$$

As shown in Table 4.8, the null hypothesis was accepted, since $p<.10$ (one-tailed). Hence, Groups 4 and 3 did not differ significantly when compared simultaneously on the two total-recall variables. However, in both cases the differences were in the direction postulated. That is, Group 4 outperformed Group 3.

Groups 4 and 3 were also compared simultaneously on the separate audio and video recall variables (i.e., A, V, A+Aw, V+Vw). The multivariate hypothesis is:

$$H_0: (\mu_{4A}, \mu_{4V}, \mu_{4(A+Aw)}, \mu_{4(V+Vw)})$$

$$= (\mu_{3A}, \mu_{3V}, \mu_{3(A+Aw)}, \mu_{3(V+Vw)})$$

$$H_1: (\mu_{4A}, \mu_{4V}, \mu_{4(A+Aw)}, \mu_{4(V+Vw)}) > (\mu_{3A}, \mu_{3V}, \mu_{3(A+Aw)}, \mu_{3(V+Vw)})$$

As shown in Table 4.8, the null hypothesis was rejected at $p<.05$ (one-tailed).

Univariate tests. Since the alternative hypothesis was accepted, the next step was to ascertain which variable(s) among the subset (A,V,A+Aw,V+Vw) accounted for the significant difference between groups. The appropriate univariate hypotheses are:

a) $H_0: \mu_{4A} = \mu_{3A}$

$H_1: \mu_{4A} > \mu_{3A}$

b) $H_0: \mu_{4V} = \mu_{3V}$

$H_1: \mu_{4V} > \mu_{3V}$

c) $H_0: \mu_{4(A+Aw)} = \mu_{3(A+Aw)}$

$H_1: \mu_{4(A+Aw)} > \mu_{3(A+Aw)}$

d) $H_0: \mu_{4(V+Vw)} = \mu_{3(V+Vw)}$

$H_1: \mu_{4(V+Vw)} > \mu_{3(V+Vw)}$

These hypotheses can be examined via Tables 4.4 through 4.7. The second null hypothesis was rejected at $p<.025$ (one-tailed). However, the other three were accepted ($p>.10$, one-tailed). Thus, while all differences were in the direction postulated, only for the correct video response variable (V) did Group 4 differ significantly from Group 3.

In summary, Group 4 outperformed Group 3 on each of the six experimental variables. However, with the exception of correct video recall, none of the differences were significant at $p<.10$ (one-tailed). Hence, Hypothesis 4 was weakly supported.

Hypothesis 5

Hypothesis 5 states that total recall will be higher among Group 5 subjects than among those in Group 6. The latter, in turn, will outperform Groups 3 and 4. In treatment six, the audio and video information tracks were disjoint. However, while the spoken audio was projected, the identical words were simultaneously printed on the screen. As stated in Chapter III, redundancy hampers recall in active learning situations where the presentation speed is moderate. This redundancy occurred in treatment six. Hence, Group 5 was expected to outperform Group 6 on the audio component. Moreover, in treatment five, video information was presented only during the last fifteen seconds of the test commercial. For treatment six, this same material was shown subsequent to fifteen seconds of on-screen printing. Hence, occular fatigue should have reduced Group 6 video recall below that in Group 5. Thus, Group 5 was expected to outperform Group 6 on audio and video as well as total recall. Two total-recall variables were calculated: C and D. The multivariate hypothesis to be tested is:

$$H_0: (\mu_{5C}, \mu_{5D}) = (\mu_{6C}, \mu_{6D})$$

$$H_1: (\mu_{5C}, \mu_{5D}) > (\mu_{6C}, \mu_{6D})$$

As shown in Table 4.8, the null hypothesis was rejected at $p<.05$ (one-tailed).

Univariate tests. Since the alternative hypothesis was accepted, the next step was to ascertain which variable(s) among the subset (C,D) accounted for the significant difference between groups. Referring to Tables 4.9 and 4.10, Groups 5 and 6 were compared using the following set of univariate hypotheses:

a) $H_0: \mu_{5C} = \mu_{6C}$

$H_1: \mu_{5C} > \mu_{6C}$

b) $H_0: \mu_{5D} = \mu_{6D}$

$H_1: \mu_{5D} > \mu_{6D}$

The first null hypothesis was rejected at $p<.025$ (one-tailed), while the second was rejected at $p<.05$ (one-tailed). Hence, Group 5 secured higher total-recall scores than did Group 6, although the difference was less significant when errors were included.

Multivariate tests. Having verified the relative superiority of Group 5 on both total-recall measures, comparisons across the separate audio and video scores were conducted. Four such variables had been calculated: A, V, A+Aw, and V+Vw. The multivariate hypothesis to be tested is:

$$H_0: (\mu_{5A}, \mu_{5V}, \mu_{5(A+Aw)}, \mu_{5(V+Vw)})$$

$$= (\mu_{6A}, \mu_{6V}, \mu_{6(A+Aw)}, \mu_{6(V+Vw)})$$

$$H_1: (\mu_{5A}, \mu_{5V}, \mu_{5(A+Aw)}, \mu_{5(V+Vw)})$$

$$> (\mu_{6A}, \mu_{6V}, \mu_{6(A+Aw)}, \mu_{6(V+Vw)})$$

As shown in Table 4.8, the null hypothesis was accepted, since $p>.10$ (one-tailed). However, the difference between vectors was in the direction indicated. Moreover, as shown in Tables 4.4 through 4.7, all four univariate t-tests were significant at $p<.10$ (one-tailed).

Comparing Group 6 with Groups 3 and 4, it was postulated that making the video track completely redundant with the audio (Group 6) would generate higher audio recall than if the video was made only partially redundant (Groups 3 and 4). Moreover, scores on video measures should also be higher in Group 6, because audio plays concurrent with video information in treatments three and four, but not in treatment six, where between-channel interference is minimized. Hence, Group 6 was expected to outperform Groups 3 and 4 on audio and video as well as total recall.

Two total-recall variables were calculated: C and D.

The multivariate hypotheses to be tested are:

a) H_0: $(\mu_{6C}, \mu_{6D}) = (\mu_{3C}, \mu_{3D})$

H_1: $(\mu_{6C}, \mu_{6D}) > (\mu_{3C}, \mu_{3D})$

b) H_0: $(\mu_{6C}, \mu_{6D}) = (\mu_{4C}, \mu_{4D})$

H_1: $(\mu_{6C}, \mu_{6D}) > (\mu_{4C}, \mu_{4D})$

As shown in Table 4.8, both null hypotheses were accepted, since $p>.10$ (one-tailed) in each case. However, all group differences were in the direction postulated. Moreover, univariate t-tests comparing Groups 3 and 6 were significant at $p<.10$ (one-tailed) for each total-recall variable (Tables 4.9 and 4.10).

Group 6 was next compared with Groups 3 and 4 on the audio and video recall variables (A, V, A+Aw, V+Vw). The multivariate hypotheses to be tested are:

a) H_0: $(\mu_{6A}, \mu_{6V}, \mu_{6(A+Aw)}, \mu_{6(V+Vw)})$

$= (\mu_{3A}, \mu_{3V}, \mu_{3(A+Aw)}, \mu_{3(V+Vw)})$

H_1: $(\mu_{6A}, \mu_{6V}, \mu_{6(A+Aw)}, \mu_{6(V+Vw)})$

$> (\mu_{3A}, \mu_{3V}, \mu_{3(A+Aw)}, \mu_{3(V+Vw)})$

b) H_0: $(\mu_{6A}, \mu_{6V}, \mu_{6(A+Aw)}, \mu_{6(V+Vw)})$

$= (\mu_{4A}, \mu_{4V}, \mu_{4(A+Aw)}, \mu_{4(V+Vw)})$

$$H_1: (\mu_{6A}, \mu_{6V}, \mu_{6(A+Aw)}, \mu_{6(V+Vw)})$$

$$> (\mu_{4A}, \mu_{4V}, \mu_{4(A+Aw)}, \mu_{4(V+Vw)})$$

As shown in Table 4.8, the first null hypothesis was rejected at $p<.06$ (one-tailed), but the second was accepted ($p>.10$, one-tailed). In the latter case, group differences were in the direction postulated.

Univariate tests. Since the alternative hypothesis concerning Groups 3 and 6 was accepted, the next step was to ascertain which variable(s) accounted for the significant difference between groups. Referring to Tables 4.4 through 4.7, Groups 3 and 6 were compared by the following set of univariate hypotheses:

a) $H_0: \mu_{6A} = \mu_{3A}$

$H_1: \mu_{6A} > \mu_{3A}$

b) $H_0: \mu_{6V} = \mu_{3V}$

$H_1: \mu_{6V} > \mu_{3V}$

c) $H_0: \mu_{6(A+Aw)} = \mu_{3(A+Aw)}$

$H_1: \mu_{6(A+Aw)} > \mu_{3(A+Aw)}$

d) $H_0: \mu_{6(V+Vw)} = \mu_{3(V+Vw)}$

$H_1: \mu_{6(V+Vw)} > \mu_{3(V+Vw)}$

The first null hypothesis was rejected at $p<.10$ (one-tailed), and the second at $p<.025$ (one-tailed). However, the latter two null hypotheses were accepted ($p>.10$, one-tailed). Hence, only when correct-score variables were used did significant results obtain. When errors were included, the group differences were nonsignificant.

In summary, the hypothesis that Group 5 would outperform Group 6 on total-recall variables was supported. However, only partial affirmation occurred when the separate audio and video measures were used. Group 6, in turn, outscored Groups 3 and 4, but most results were nonsignificantly different.

Hypothesis 6

Hypothesis 6 states that variance within Group 5 should exceed that in Group 6, which, in turn, should surpass the variances within Groups 3 and 4 (i.e., $s_5^2 > s_6^2 > s_3^2, s_4^2$). That is, the widest dispersion was expected when one channel only was projected during each commercial instant (Group 5). Conversely, a narrow dispersion was anticipated when multiple channels were utilized (Groups 3 and 4). Medium variability was expected in two-channel presentations where the second channel is completely redundant to the first (Group 6).

To test these hypotheses, comparisons were made on total-recall variables C and D. The hypotheses for each variable are:

a) $H_{01}: \sigma^2_{5j} = \sigma^2_{3j}$

$H_{11}: \sigma^2_{5j} > \sigma^2_{3j}$

b) $H_{02}: \sigma^2_{5j} = \sigma^2_{4j}$

$H_{12}: \sigma^2_{5j} > \sigma^2_{4j}$

c) $H_{03}: \sigma^2_{5j} = \sigma^2_{6j}$

$H_{13}: \sigma^2_{5j} > \sigma^2_{6j}$

d) $H_{04}: \sigma^2_{6j} = \sigma^2_{3j}$

$H_{14}: \sigma^2_{6j} > \sigma^2_{3j}$

e) $H_{05}: \sigma^2_{6j} = \sigma^2_{4j}$

$H_{15}: \sigma^2_{6j} > \sigma^2_{4j}$

where j = {C,D}. From Table 4.11, H_{03} for variable C was rejected at $p<.025$ (one-tailed), while $p<.10$ (one-tailed) when variable D was used. Hence, variance within Group 5 was significantly larger than that in Group 6. Video measures seemed to account for these results, since s^2_{5V} (i.e., sample variance within Group 5 when V was the response variable) differed from s^2_{6V} at the $p<.05$ level (one-tailed). For V+Vw, the significance level was $p<.10$ (one-tailed). However, comparisons using the audio-related variables (A, A+Aw) were in the direction postulated, but nonsignificantly so.

Null hypotheses H_{04} and H_{05}, which concerned Group 6

TABLE 4.11

F TESTS COMPARING WITHIN GROUP VARIANCES ACROSS PAIRS OF TREATMENT GROUPS[a,b]

VARIABLE / GROUPS COMPARED	A	V	C	A+Aw	V+Vw	D
3,4	1.49[g]	1.55[h]	1.71[g]	1.16[g]	1.89[g]	1.41[g]
3,5	2.48[e,g]	2.33[f,i]	1.31[g]	1.57[g]	1.33[i]	1.01[g]
3,6	2.85[e,g]	1.15[g]	4.28[c,g]	2.06[f,g]	1.70[g]	2.17[f,g]
4,5	1.66[h]	1.50[i]	1.31[i]	1.36[h]	2.52[e,i]	1.40[i]
4,6	1.91[h]	1.79[h]	2.51[e,h]	1.78[h]	1.11[h]	1.54[h]
5,6	1.15[i]	2.68[e,i]	3.28[d,i]	1.31[i]	2.27[f,i]	2.16[f,i]

[a]Since N=15 in all treatment groups, critical values for F are based on df = 14, 14.

[b]Each cell value represents $F = s^2$ largest/s^2 smallest, where s^2 are within group sample variances.

[c]$p<.01$.

[d]$p<.025$.

[e]$p<.05$.

[f]$p<.10$.

[g]s^2 for Group 3 is larger than that of the comparison group.

[h]s^2 for Group 4 is larger than that of the comparison group.

[i]s^2 for Group 5 is larger than that of the comparison group.

[j]s^2 for Group 6 is larger than that of the comparison group.

versus Groups 3 and 4, were accepted. Moreover, differences were contrary to the direction postulated. That is, s_{3j}^2 and s_{4j}^2 were larger than s_{6j}^2 for both C and D. For C, these differences were significant at $p<.05$ (one-tailed). Using D, $p<.10$ (one-tailed) for Groups (3,6), while the Groups (4,6) comparison was not significant at $p<.10$ (one-tailed).

Null hypotheses H_{01} and H_{02}, which concerned Group 5 versus Groups 3 and 4, were also accepted for both C and D. While the s_{5j}^2 were larger than the variances within Groups 3 and 4, the F statistic was not significant at $p<.10$ (one-tailed). However, for Groups (3,5), significant differences obtained when A and V were the response variables. When errors were included, nonsignificant differences were indicated.

In summary, the hypothesis that variance within Group 5 would exceed that within Group 6 was supported. There was also weak verification that variance within Group 5 was larger than that within both Groups 3 and 4. Postulates concerning Groups (3,6) and (4,6) were not supported.

Summary

The results of this inquiry were detailed in Chapter IV. Hypothesized differences in recall scores associated with different modes of audio-visual presentations were tested with the following outcomes.

1. When audio (video) information was presented without background video (audio), more material was attended and

recalled than when the audio (video) track appeared simultaneously with relevant video (audio), regardless of the level of information content in the secondary channel. This superiority of single channel presentations was significantly supported when audio-only, video-only, and audio-video comparisons were made across treatment groups.

2. When information was projected on one stimulus channel (i.e., audio or video), recall was diminished as information content in the secondary channel was increased. That is, when salient audio script was presented, recall was highest when the video channel was terminated. It was significantly less when video completely redundant to the audio was simultaneously projected. Further, but nonsignificant decrements obtained when video that was only partially redundant to the audio was presented. This decrement was directionally stronger, the more information that appeared in the partially redundant video.

When video served as the informative channel, recall was highest when the audio channel was terminated. It was significantly less when low content video (i.e., background musical notes) simultaneously played. A further significant decrease obtained when high information content audio was used in the secondary channel.

These findings occurred in an active learning situation where a moderate speaking rate was used. The video was rapid, but clearly visible to subjects.

3. When information was presented on only one stimulus channel during each instant, wider variance in recall scores obtained than when two channels were simultaneously projected, regardless of the amount of between-channel redundancy. These effects were directionally supported, but significant only when the disjoint versus completely redundant comparisons were made. For two-channel presentations, greater variance occurred in the partially redundant cases than in the completely redundant one. This greater variance was contrary to the researcher's expectations.

C H A P T E R V

CONCLUSIONS

The last chapter of this dissertation discusses the major findings and explores the significance and limitations of the research. The chapter concludes by suggesting additional directions for future study.

Discussion

Theoretical Issues

The research hypotheses tested the salience of Broadbent's model of selective attention to television commercial viewing settings. Differences in short-term recall when relevant audio and video information were presented disjointly as opposed to concurrently were explored. Information content in the 'unimportant' secondary channel was also manipulated.

As stated in Chapter I, Broadbent's model implies that when audio and video are simultaneously presented, only one is attended. The unattended channel is not analyzed for content, context or meaning. In the dissertation research, attention was not measured directly in the usual tachistoscopic format of immediate recall. The objective was to ascertain if selective attention operated in conventional television viewing situations. Hence, short-term recall was used as the surrogate attention measure. The multiple choice questionnaire was administered approximately twenty seconds after the commercial ended. Since iconic and echoic memories have a maximum duration of ten seconds, the twenty second delay meant responses were being extracted from longer-term memory. If information was recalled, it was either attended or chosen by fortuitous guessing. Material not recalled may or may not have been attended. That is, incorrect recounting of attended stimuli could have obtained because the individual was unable to extract the information from long-term memory. To the extent that memory failures occurred, attention levels were underestimated.

Concerning the recall questionnaire, memory failures could have been responsible for errors as well as 'I don't remember' designations. However, both types of incorrect responses might have occurred because the stimuli were not attended. The current research only partially examined the meaning of incorrect answers. Exploratory hypotheses assumed that errors represented attended, but improperly recalled stimuli. To test these postulates, recall scores including both correct and error responses were calculated. Intergroup differences were expected to be larger when errors were counted. It was postulated that differences in mean correct scores represented alternate attention levels. If errors also constituted attended stimuli, then more errors should have occurred in higher than in lower scoring groups. Hence, between-group differences were expected to widen when errors were included. The data analysis did not support this expectation. In most intergroup comparisons, significance levels were higher when only correct answers were used as the recall measures. The implication was that errors represented primarily fallacious answers as opposed to partial recalls of attended stimuli.

Unless subjects with partial recall of experimental stimuli were more prone to check 'I don't remember' (IDR) than to guess wrongly, IDR responses were probably no stronger attention indicants than were errors. Some subjects did profess an aversion to guessing. For them, unless information was explicitly recalled, no definitive answer was given. However, most Ss were statedly more prone to guess. That is, unless a memory blank obtained, some answer other than IDR was designated. It was probable that most IDR responses indicated lack of attention rather than cognitive confusion about attended stimuli.

With short-term recall as the response measure, Broadbent's thesis translates into the following paradigm: when audio and video information are presented simultaneously, only one among these is recallable. Both cannot be recalled because the limited capacity filter allows only one information bit at a time to be attended. The unattended material can subsequently be attended as long as it remains in iconic or echoic storage. However, these short term memory systems have limited capacities, with entering stimuli evicting lingering unattended material unless the unattended stimuli are actively rehearsed. Rehearsed stimuli can be repeatedly recycled through iconic or echoic memory. However, in the present study, new audio-video information was continually projected, and subjects had no reason to believe that one subset of this information was more important to recall than other subsets. Thus, frequent active rehearsal was not expected. Hence, data that was unattended during the instant it was presented was probably not recalled in subsequent testing.

The Broadbent paradigm implies that if audio and video information are simultaneously projected, short-term recall will be lower than if the audio and video are disjoint. While the information content within each channel affects the degree of between-channel interference, and hence the difference between mean recall scores, the existence of interference requires only that multiple-channel as opposed to single-channel presentations occur. The experimental verification of hypotheses one, two and three supported this paradigm. When the audio information track was shown without competing video, recall was significantly higher than when either low or high content video was concurrently presented. Rendering the video completely redundant to the audio generated nonsignificantly lower recall than in the audio-only case (although significance was obtained when Group 5 audio (single-channel) was compared with the redundant Group 6 treatment).

Similarly, when the video information was shown without competing audio, recall was significantly higher than when either low or high content audio was simultaneously presented. More importantly, when the audio and video tracks were disjoint, recall was significantly higher than when either low, high, or completely redundant content appeared in a competing secondary channel.

The experimental findings indicated that selective attention may operate in television commercial settings. Whenever two channels were utilized, recall dropped significantly, even when one channel had minimal information content. Maximum recall was evidenced in single-channel designs.

As noted in Chapter I, some theoreticians reject the Broadbent explanation of perceptual limitations. An alternative paradigm is outlined by Deutsch and Deutsch [30] and Norman [91]. Their model claims that people can simultaneously attend to more than one input channel. Thus, all perceived stimuli are attended and enter long term memory. However, simultaneous responses to these multiple stimuli are impossible. Such response competition is claimed to account for those information processing limitations observed in experimental settings. In the standard laboratory format, Ss are asked to react immediately to multiple stimuli that are simultaneously presented to S's senses for very short time periods (less than 500 milliseconds). Typically, responses to but a single stimulus are given. Such univariate responses to multivariate input are consistent with both the Broadbent and response-competition theories.

The current research was more supportive of Broadbent's paradigm. Since time delayed and non-simultaneous responses were required, the response competition model could not readily explain the apparent interference between simultaneously presented audio and video information tracks. That is, if all presented material was attended and stored in long term memory, why did Ss recall significantly more data when A and V were disjoint as opposed to concurrent? Deutsch and Deutsch might claim that sequentially presented information is stored differently in longer term memory than is concurrently presented stimuli, with the sequential data more easily retrievable. If the explanation is accurate, then conscious adaptation of advertising messages is facilitated by the dissertation model. However, subconscious assimilation may not be.

To further clarify the issue, secondary-channel information was manipulated. The findings indicated that the amount of information content in a secondary channel was inversely related to recall of the primary channel message.

Ceteris paribus, the attention value of a stimulus channel is directly related to its information content. Hence, the more data projected on a secondary channel (e.g., C_2), the larger that channel's attention value to viewers. The likely outcome, according to equation 10 (page 28), is reduced attention to the primary channel (e.g., C_1). Equation 10 states that

$$P(AC_{1_j}) = a_1 / \sum_{i,j=1}^{m,n} a_i + I_j$$

where a_i terms are attention values. Hence, as a_2 was experimentally increased, the denominator of equation 10 got larger, and $P(AC_{1_j})$ decreased. It was assumed that attention and short term recall were positively related. Thus, if selective attention operated, primary message recall should have decreased as secondary-channel content increased. Research findings supported this postulate. Since Deutsch and Deutsch's model could not adequately explain this content effect, the existence of perceptual limitations in television commercial viewing settings was supported.

Empirical Issues

Having verified the 'superiority' of single-channel designs, it was recognized that multiple-channel formats are sometimes desired, since the attention value of a television commercial is positively related to the number of channels per instant. It was postulated that single-channels generate different aggregate recall patterns than do multiple-channels. When single-channels are employed, viewers who actively watch the commercial attend to much of the information presented. However, because the attention value of such designs are low, many viewers switch attention to non-television stimuli. Adding a second channel, completely redundant to the first, was expected to reduce the number of viewers switching away from the television. Incompletely redundant multiple-channel formats, on the other hand, possess higher attention value. Most people are likely to attend these advertisements. However, between-channel interferences will probably hamper assimilation of information.

Operationally, these postulates can be stated in terms of hypothesized intergroup differences between mean recall and variability of recall of the experimental A and V stimuli. Single-channel treatments were expected to generate highest mean recall and variability among A and V scores. This postulate was significantly supported. Incorporating a second channel, and making it completely redundant to the already employed single-channel, was expected to provide lower group means and variances on A and V recall than obtained in the single-channel-only format. This postulate was directionally verified, but statistical significance was lacking. Utilizing two channels that were incompletely redundant to each other was expected to give lowest group means and variances on A and V recall. This postulate was only partially supported. That is, single-channels generated higher group means and variances than did the incompletely redundant two-channel treatments. However, the incompletely redundant two-channel designs generated lower means, but higher variances of recall than did the completely redundant two-channel treatment.

Several factors may have accounted for these mixed results with respect to variances: (i) relatively small, homogeneous samples were used. Aggregate characteristics of the general television viewing population differed from the aggregate characteristics of experimental subjects in many ways (e.g., age composition and educational levels). Hence, the research findings might not be generalizable to the larger audience; (ii) many subjects reported that they concentrated more intently while watching the experimental videotape than they did when viewing in-home television programming. Heightened concentration obtained because Ss knew they were in a laboratory setting and expected to be examined on the material presented. Hence, an active learning situation obtained. As discussed in Chapter I, having an active as opposed to a passive learning task qualitatively alters the response profile to two-channel presentations where the second channel is completely redundant to the first channel. Specifically, lower recall is generated in the more passive learning situation; and (iii) the presentation speed was empirically realistic, but it was slow enough to render inefficient the two-channel format which utilized complete interchannel redundancy. Factors (ii) and (iii), while most directly affecting absolute recall, could also have influenced the variability of recall.

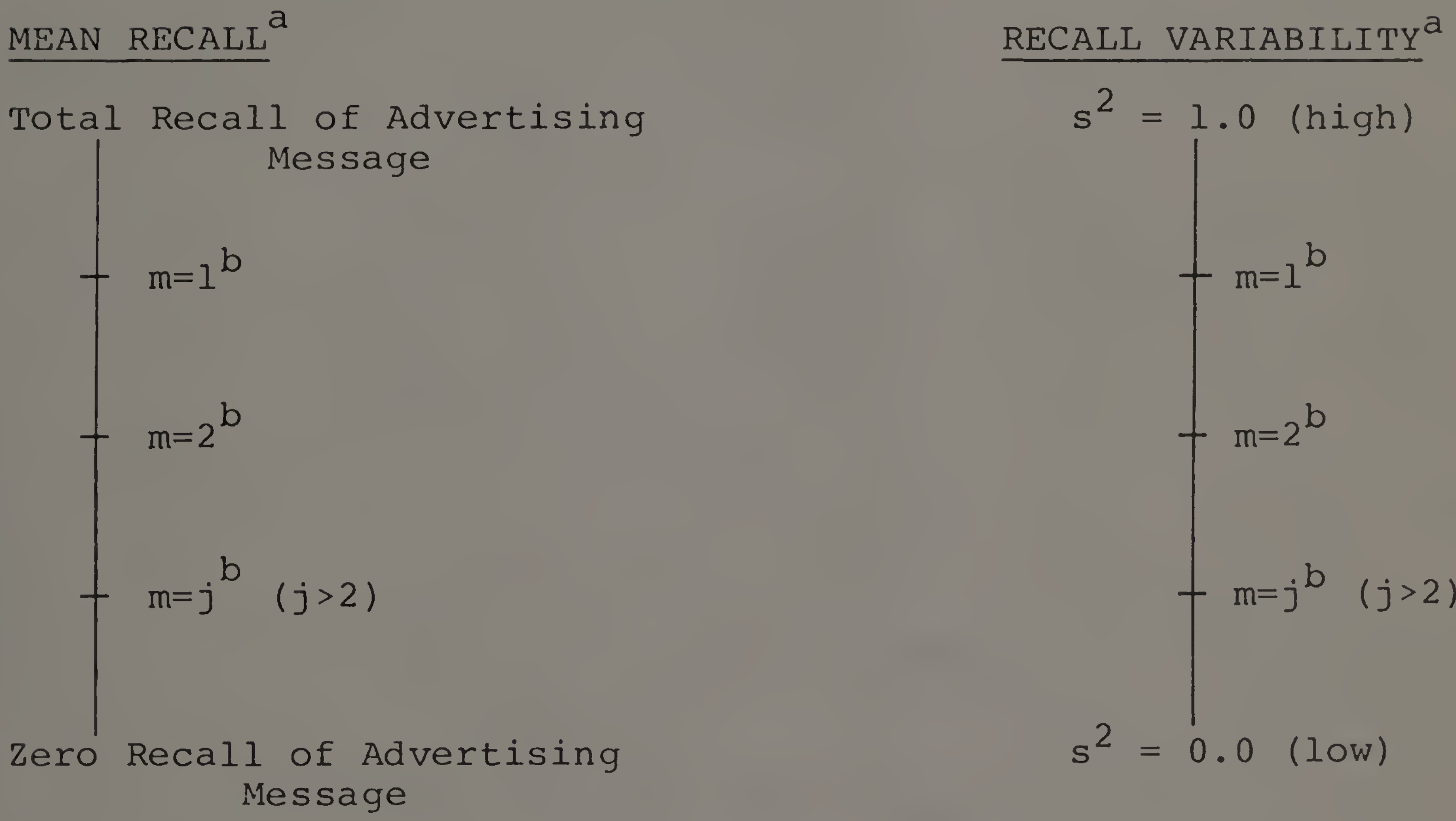
Issues of Application

Those hypotheses that were supported have several managerial implications. The findings suggest that advertisers can trade-off between alternative audience attention profiles to televised commercials. That is, by employing single-channel designs, mean recall of the advertising message and recall variability are both likely to be higher than if multiple-channels are utilized. Figure 5.1 provides a pictorial representation. Given the research limitations, postulated channel-related differences in measures of recall and variability employed ordinal scales. That is, precise distances between measures are not given. Only the relative ordering of recall scores and variances are presented. Specifically, if alternative channel strategies are contemplated, the theory reveals which method will generate higher recall (variability). Interval distances between measures are not predicted. The current exploratory study was not designed to ascertain interval or ratio relationships. Rather, verifying the existence of channel-related differences in recall and recall variability were the primary objectives.

For any advertiser, the relative merits of single

FIGURE 5.1

RELATIONSHIP BETWEEN NUMBER OF INPUT CHANNELS EMPLOYED AND THE AGGREGATE MAGNITUDE AND VARIABILITY OF AUDIENCE RECALL



[a]Ordinal scales are utilized.

[b]m refers to the number of incompletely redundant stimulus channels.

versus multiple-channel approaches are functions of several variables.

1. <u>Information content of the advertisement</u>. Assume the marketer's objective is to maximize information received by the audience. Ideally, complete attention and recall among all audience members is desired. However, the discussion above implies the following outcomes are more likely: (a) high (in an ordinal context) attention and recall among a segment of the audience, with the remaining viewers assimilating almost nothing. This profile is expected when single-channels are employed during each commercial instant. Examples include audio-only advertisements (e.g., aural verbal messages), video-only advertisements (e.g., silent pictorial messages), and audio-visual commercials where A and V are disjoint (e.g., audio and video channels are alternated every few seconds); or (b) low(er) (in an ordinal context) attention and recall among most viewers. This profile is expected when multiple channels are employed during each commercial instant. Examples include advertisements that simultaneously utilize instrumental music, lyrical or aural verbal script, background video and/or on-screen printing. Specifically, Coca Cola advertisements simultaneously present lyrical music, instrumental music and background video. Thus, three stimulus channels are concurrently projected.

Assume that the advertising message is effective only if some threshold level of information is attended. For example, in a problem-solution commercial, the viewer is presented with a problem to be solved. The sponsor's product is deemed the remedy to that problem (e.g., Dixie Cups are posed as a solution the hygienic problems associated with multiple-person usage of bathroom drinking glasses). If viewers attend to the problem but not the sponsor's product (or vice versa), then the desired advertising impact is unattained. Effectiveness requires audience attention to both the problem and the offered solution. In those cases where advertising effectiveness requires viewer attention to some threshold level of information, single-channel designs would probably be effective among more viewers than would multiple-channels, since mean recall is likely to be highest when single-channels are employed.

Now assume that there are gradient levels of advertising effectiveness. That is, instead of effectiveness requiring some threshold level of attended information, effectiveness is continuously directly related to the amount of stimuli attended. If little (much) information is attended, then little (much) effectiveness obtains. Examples would be commercials that enumerate several positive attributes of the sponsor's product. The more (less) attributes viewers attend, the more (less) effective the advertisement. An appropriate channel strategy is not predeterminable. Rather, comparing the aggregate sales (or other) response functions for single and multiple-channel communications would be necessary.

Not all advertisements are designed to convey a large amount of information. As stated in Aaker and Myers [1, page 148]:

> To distinguish brands from competitors that are offering closely competing substitutes, it will generally pay to rest the copy platform on one product advantage or attribute and build the advertising program around that theme.

Moreover,

> Brands that occupy a very strong position in a market can sometimes afford to adopt what amounts to diffuse image strategy . . . a conscious effort can be made to avoid becoming explicit on any particular feature. The advertising may then contain very little 'information' in a functional sense. . . . Budweiser's claim that Bud is the 'king of beers' . . . illustrates this strategy.

Classic experiments by Asch [3] indicated that when stimuli are incomplete, people strive to form complete impressions of objects or persons. Thus, advertising copy does not necessarily have to paint the entire picture: individuals will fill in the gaps naturally. Hence, limited information content might be desirable (e.g., present the few attributes that are central to the conceptual configuration of the product in question: viewers will then construct their entire brand image from this small amount of available data).

Where the marketer wishes to convey little information content, multiple-channels are advisable, since most viewers would assimilate the limited message. Single-channels would generate greater variability in respondent attention levels. Hence, many viewers would not absorb the message.

Information content is strongly correlated with the focus of the advertisement. That is, which aspect of the commercial the advertiser wishes the audience to attend will influence the amount of information presented. The subject of advertising focus is discussed below.

2. Focus of the advertising message. Every commercial message focuses the audience's attention on one of three components [1, page 403]: (i) the source (i.e., media vehicle or spokesperson). Here the actions, voice and role position of the source are significant (e.g., Haynes Pantyhose commercials using Joe Namath as the spokesperson); (ii) emotional aspects. Here the focus is on the emotional milieu. The purpose is to put the audience in a pleasant mood, enhance and bolster their egos, or utilize some type of emotional appeal (e.g., Noxzema commercials with Farrah Fawcett Majors); (iii) product related claims. Here attention is directed to the facts presented, with the objective of encouraging the audience to purchase the product because of logical deductions from the facts presented (e.g., Bufferin commercial where the product is compared with its major competitors).

Information content is likely to be greatest in advertisements focusing upon product-related claims. Where source or emotional aspects are highlighted, less factual content is probable. If so, multiple-channels are most appropriate. However, if the source or emotional impact requires detailed attention to the message, a single-channel design is best.

If attention to product-related claims is desired, the relative efficacy of single and multiple-channels depends on the amount of information projected. Information content, in turn, is a function of redundancy within the commercial. The topic is discussed below.

3. Redundancy within the advertisement. If there is redundancy in the commercial, where redundancy is defined as repetition of identical words, pictures, musical notes and/or jingles, then material will be assimilated if any of the multiple repetitions are attended. An implication is that continual attention to the advertisement is not necessary. If redundancy obtains, multiple-channels are advised. The attention focus associated with multiple-channel designs is quite fluid. That is, the viewer is likely to alternate attention between A, V and non-television stimuli. Hence, if information is repeated, attention to the data will probably occur sometime during the commercial. The prospect is greater, the more that redundancy is employed.

Conversely, the less redundancy used, the more single-channels are favored, since, ceteris paribus, information content will be higher when nonredundant rather than redundant material is presented.

4. Competitive position of the firm. A dominant or leader firm in an industry (e.g., Coca Cola, McDonald's Hamburgers) might choose a multiple-channel strategy with the purpose of having a large number of the audience members perceive the product category, and hence, inferentially, the dominant firm's product by association. Conversely, a less well-established firm trying to penetrate one or more market segments might choose a single-channel approach. This strategy facilitates projecting much of the advertising message to certain subsets within the total audience. Identifying and characterizing these subgroups are not explored in this dissertation. Rather, the study reveals only that certain undesignated viewers will attend the information. How to coordinate this respondent profile with the organization's segmentation strategy is not indicated.

5. Amount of consumer information search. Many factors influence the amount of information used in consumer decision making. According to Engel, Kollat and Blackwell [37], there are two types of information search: internal (e.g., own past experiences) and external (e.g., advertisements). If internal sources prove inadequate, consumers may seek external data to clarify intentions. However, external search is not a black and white matter. Rather, the extent of information gathering varies widely. It is postulated that the most influential determinants are:

(i) External search is related inversely to the length and breadth of past experience with the given product [45,61];

(ii) The more satisfied the customer has been with past purchases, the less likely is future external search [8,64];

(iii) External search is positively related to the interpurchase time interval (i.e., the mean time between purchases) [64];

(iv) External search relates directly to importance of style and price, and frequency of new product introductions [63];

(v) External search increases with the degree of perceived financial, social and/or physiological risks associated with purchasing the product. That is, goods high in price (e.g., housing), goods requiring lengthy use commitments (e.g., university degree programs), and items high in social visibility (e.g., clothing) and/or physical peril (e.g., parachutes) are likely to generate much external search behavior [26,27,33,36,44,64,119];

(vi) External search increases as the number of separate decisions required to make a single purchase increases [24,33]. For example, the purchase of some products (e.g., automobiles) mandates that consumers decide upon color, size, style, optional features and so on;

(vii) External search depends upon consumers' risk styles and strategies. Cox [23] suggests two styles are commonly employed to reduce risk: 'clarifying' (i.e., when confronted with ambiguity, additional information is sought) and 'simplifying' (i.e., conflicting information is selectively rejected to simplify the decision making context). Definitionally, external search is more pervasive under clarifying behavior. Bauer [6] postulates specific types of risk-reducing strategies (e.g., buying only nationally advertised brands). In purchase situations where these programmed strategies are used, external search will be greater if strategy switching is contemplated. Information is needed to evaluate the alternatives;

(viii) External search delays purchase decisions and, hence, the extraction of utility from products. The greater the perceived delay, the lower the intensity of external search. In other words, the more urgent the need for a product, the less external search is undertaken [64,74];

(ix) The greater the consumer's need for variety, the more intense the external search [64];

(x) Various personality characteristics have been related to external search. First, closed-minded consumers have been found less sensitive to information than open-minded consumers [9,44]. Second, people who feel confident about their ability to control their environment tend to be information sensitive [44]. Finally, the more 'dependent' the consumer, the less external search conducted [16];

(ix) Family role structures are also important. The degree of external search is lower among families in which decision making is performed by one member than it is in families having multi-person participation [37, page 382]. There is also some evidence that when females engage in major physical duties associated with operating a household, their external search will be maximal [20];

(xii) Social class and social position have been found related to external search [79,116]. Transient households and those with high social standing have low tendencies to search. Aging, economically unstable households are most prone to search externally [20]; and

(xiii) Some studies indicate that search is likely to be greater when the consumer is under 35 years of age, has more than a high-school education, and is in the middle-income category [53,64].

It is important to recognize that the effect of these variables is not certain. Rather, tendencies toward more or less information search are indicated. Furthermore, it is combinations of variables that are most germane. Little research has been conducted on the relative importance of search determinants.

Nevertheless, factors (i) through (xiii) provide guidelines on whether the courted population segment is or is not information responsive. If the target market is deemed sensitive, and television is the chosen vehicle, then high content television advertising copy is propitious. Thus, single-channel designs are recommended. More salient information can be transmitted to more potential customers by using single as opposed to multiple-channels. The converse is true for segments low in information responsiveness. Here, effective reach might occur if brand name and few product attributes are attended by the target audience. The multiple-channel design can best generate this audience profile.

6. Stage of the product life cycle. There are four stages in the life cycle of a product: introductory, growth, maturity and decline. During the introductory period, competition is subdued, with marketers' energies devoted to promoting the fledgling item. 'New' products [102] may be (i) continuous innovations. Alterations of existing products rather than creation of new products are involved. Examples include annual new-model automobile changes and 100 millimeter cigarettes; or (ii) dynamically continuous innovations. Although new consumption patterns among potential users are not required, these innovations constitute new products or major modifications of existing products. Examples include electric toothbrushes and color televisions; or (iii) discontinuous innovations. Establishment of new consumption patterns and the creation of previously unknown products are involved. Examples include computers and lasers.

While the designations are somewhat arbitrary, implications for consumer information requirements may be drawn. Ceteris paribus, the more discontinuous a product, the more information consumers require. This postulate is based upon the notion that external search varies inversely with the length and breadth of past product experience. Hence, the 'newer' the product, the more efficacious are single-channel television commercials. Such designs are most suitable for extensive information transmission. Moreover, regardless of the type of 'newness,' consumers will have less knowledge and experience during the introductory than during later stages in the product life cycle. Hence, information requirements tend to be greatest during the introductory stage, thus giving single-channel formats a comparative advantage.

Intense competition emerges during the growth and maturity stages. Thus, companies are prompted to search for new segments and to increase emphasis on product differentiation and recycling (i.e., finding new uses for existing products). No clear channel strategies are indicated, since advertising responses to competition may vary. One firm might employ comparative advertising while another might favor emotional appeals. Numerous other strategies are also feasible. Concomitant with different strategies will be different objectives and information content, thus negating global channel recommendations.

Products may be phased out or eliminated during the decline stage, since sales are shrinking absolutely over time. While being eliminated, items can still be profitably sold to residual customers. Most likely, these clients possess sufficient product-related knowledge. Thus, little information need be presented to them. Multiple-channel designs focused at this target segment are advised. This strategy is likely to maintain brand awareness and comprehension among most of the residual customer base.

Products in the decline stage are not necessarily omitted from the company's line. A 'repair job' might be performed. That is, maladaptive product features can be altered, thus converting the item into a quasi-new product. If so, the good might revert to an earlier life cycle stage. The appropriate channel strategy would follow accordingly.

Advertising Strategies

In terms of channel usage, the above discussion implies four advertising strategies firms might employ.

1. Multiple-channel presentations only. This strategy is most efficient where all the following conditions prevail: the organization is a dominant firm in an industry; the product is in a post-introductory stage of its life cycle; the target market is deemed information insensitive; and the advertising copy is high in redundancy and low in information content.

2. Single-channel presentations only. This strategy

is most efficient where all the following conditions prevail: the organization is not a dominant firm in an industry; the product is in the introductory stage of its life cycle; the target market is highly information sensitive; and the advertising copy is low in redundancy and high in information content.

What strategy is appropriate if some conditions favor single-channels while other factors recommend multiple-channel designs? Advertising objectives should be enumerated. Using these guidelines, the relative importance of maximal audience attention to some of the advertising copy (attainable by multiple-channels) versus maximal attention to the advertising copy by portions of the audience (attainable by single-channels) can be determined. If the results are equivocal, combinations of channel strategies might be employed.

3. Multiple-channel presentations followed by single-channel designs. The strategy would initially generate widespread brand awareness and then in-depth knowledge within segments of the total market. For example, a nondominant firm introducing a new product might opt for advertising copy that is high in redundancy and low in information content (e.g., the product is a structurally and operationally simple, fadish item like the hula hoop). The information structure favors multiple-channels. As the product enters its growth stage, competition emerges. The firm might react by incorporating more information into its ad-

vertising copy (e.g., enumerating alternative product uses). If so, single-channel designs would then be more appropriate.

4. Single-channel presentations followed by multiple-channel designs. The strategy is appropriate when an organization initially penetrates a few market segments (using single-channel formats), and then seeks to broaden its customer base via multiple-channel advertising.

Secondary-Channel Strategies

Assume that a multiple-channel format is utilized, with salient information projected on one of these channels. What content should appear in the secondary channels? As the current study verified, aggregate attention (recall) levels are inversely related to the information and/or interest content within secondary channels. That is, recall of the primary message increased as content within the secondary channel was decreased. A further recall increase obtained when the second channel was rendered completely redundant to the first.

Furthermore, as revealed in Table 4.11, aggregate variability in attention (recall) was directly related to the secondary channel's information content. That is, variance was smallest in the completely redundant case, larger in the low-information treatment, and largest in the high-information case.

Hence, the more attention gathering stimuli in the secondary channel, the lower the mean and the higher the variability of aggregate attention (recall) scores. A low mean-high variability profile is undesirable. Low (high) attention among most (few) viewers is likely. The configuration is dominated by attenuating all secondary channels. Here, moderate (high) attention among most (few) viewers is probable. The implication is that multiple-channel designs should minimize information and interest content in secondary channels.

Utilizing the Model of Input Stimuli Channel Strategy

A theoretical model for constructing efficient television advertising copy was developed in Chapter II. The method will now be operationalized. Once advertising objectives (e.g., increasing brand recognition by 10%) and strategies (e.g., deploy a comparative advertising campaign) have been enumerated, the appropriate channel design is selected. The findings of this dissertation provide guidelines for making the channel decision.

Generally, two or more channels are projected during any advertisement. Whether these stimuli are shown simultaneously or disjointly is the decision problem. For discussion purposes, assume one audio (e.g., aural verbal) and one video (e.g., pictorial script) channel are employed. The advertiser must delineate what information he wishes to transmit via each of these stimulus tracks. Let X equal the number of instants of A information that are important to project. Then, assuming the commercial is 30 seconds in length, there are 30-X instants of background A. Similarly, let Y and 30-Y represent important and unimportant V.

If a multiple-channel format is desired, the X and Y material are presented simultaneously, as are the 30-X and 30-Y segments. Using these guidelines, copy that is artistically valid, not perceptually confusing, and consistent with the advertising strategy is developed. Intrachannel redundancy (i.e., within-channel repetitions of stimuli) and a low information content script are advisable. The discussion of secondary channels (page 131) implied that maximum attention and recall to salient data is best obtainable by making one among X and Y low in information and interest content.

If a single-channel design is warranted, then X and Y are sequenced in a disjoint fashion. The current research did not address optimal sequencing issues. Thus, given the present level of knowledge, any ordering that is artistically satisfactory, not perceptually confusing, conforms to the rules of the relevant spoken language, and does not require rapid back-and-forth switching between A and V is acceptable. Little intrachannel redundancy and a high information content script are recommended. The current research did not indicate what specific material should be presented on a designated input channel during a designated instant of the commercial. Only the sequencing of predetermined script was examined. When any X or Y data are transmitted, the alternate channel should be terminated. These 'dead' spots are included in the 30-X and 30-Y portions.

If very slow or very fast presentation speeds are employed, then opt for an alternative design. During broadcasts of X, V should be rendered completely redundant to X. This strategy is feasible if X consists of aural verbal or lyrical music. Here, printing completely redundant to the verbal message is shown. If X includes instrumental music, then complete redundancy is not possible. Instrumental sounds cannot be presented on-screen. Hence, the options include incomplete redundancy (e.g., print musical notes on the screen) or termination of V. Research discussed in Chapter II favors the single-channel strategy. Incomplete redundancy may generate perceptual interferences.

Making A completely redundant to Y is generally not possible. Verbal duplications of visual scenes cannot be developed unless the V consists of on-screen printing. Hence, complete redundancy is not broadly applicable.

Significance

The dissertation research is of significance to information processing theorists. Specifically, the generalizability of perceptual limitations to television advertising settings was addressed. The findings provided support for Broadbent's selective attention paradigm. That is, subjects were apparently unable to simultaneously attend stimuli on more than one input channel. The results were less readily explainable by Deutsch and Deutsch's response-competition model.

The current study also has significant policy implications for both television advertisers and public authorities. Utilization of the television media is very expensive. Hence, gaining maximum effect from each second of on-air time is important. The theory presented and tested indicates methods advertisers can use to best generate the desired level of attention and message content recall among viewers. Strategy recommendations are thoroughly discussed in the paragraphs above. The competitive position of the firm, extent of consumer information search, stage in the product life cycle, focus of the advertisement, and redundancy and information content within the commercial determine whether single, multiple, or mixed-channel designs are best. The stated decision rules can help marketers formulate more effective and efficient advertising copy, thus providing competitive advantages over firms not utilizing this strategy.

During recent years, public policy makers have been requiring television advertisers to include certain designated information in their messages (e.g., disclaimers, miles-per-gallon figures). The dissertation research indicates that unless these information bits are properly sequenced and coordinated with respect to the remaining stimuli being projected, they may not be perceived by the audience. Specifically, when the required information is presented on one channel (e.g., printed on the television screen), all other channels should be terminated. Otherwise, marketers could simultaneously show interesting stimuli on a competing channel, thus drawing the audience's attention away from the prescribed message. Because of the selective attention phenomenon, policy requirements would be subverted. Hence, public authorities might want to require single-channel usage when mandated information is displayed.

Limitations

Possible limitations of this research are: sample selection, sample size, the experimental commercials, redundancy manipulations, the experimental setting, the attention measure, recall tasks, and the narrowness of the inquiry.

Sample Selection

Subjects were not randomly sampled. Rather, convenience sampling was employed. Most Ss were students in introductory undergraduate marketing courses. Participation was a class requirement. The remaining subjects were recruited at the experimental site. That is, lounging students were approached and asked to participate.

The resulting sample was biased in at least two ways: (i) only students were utilized. In terms of educational levels and age distribution, student subjects were not representative of the aggregate television viewing audience; and (ii) most Ss were undergraduate business majors. These individuals were likely to have above normal interest in and prior knowledge of television advertising strategies.

The indicated biases limit the permissible generalization of the research findings to larger audiences. It seems reasonable to expect that attention processes are functionally related to age, educational background, and interest level. Hence, employing a homogeneous subject set helped negate the possibility that intergroup differences in recall and recall variability were respondent-based as opposed to treatment-based. Thus, existence of selective attention among a subset of the entire television audience was verified. Applicability to the larger population is unwarranted.

Sample Size

Relatively small sample sizes were employed. In four of the six treatment groups, 15 Ss were used. Ten subjects were in each of the two remaining groups. Difficulty in attracting subjects prevented larger groupings. The statistical processing of the research data consisted of Hotelling T^2 analysis. An underlying assumption was that observations in each treatment group were independently normally distributed. The smaller the sample size, the less likely is this assumption to be valid. Hence, in the current research, normality may not have obtained. If so, the validity of the statistical analysis is questionable.

Experimental Commercials

The test commercials were unreflective of conventional advertising in several ways: (i) the treatments were constructed by student technicians using outdated audiovisual equipment. Hence, the technical quality of the broadcasts was subpar; (ii) the A and V scripts were high in information content. High content was required to ascertain the existence of perceptual limitations. However, most television advertisements are likely to display less information than appeared in the treatment commercials. While perceptual interferences emerged under the treatment conditions, the problem may not exist when less material is presented. As stated above on page 4, when information is arriving at a slow rate through more than one perceptual system, all that reaches the point of recognition may be attended. The multiple sources together provide less information than the system can handle. Conventional advertisements might satisfy these requirements. If so, selective attention might only apply in laboratory settings; (iii) the test commercials directed audience attention to product-related claims. Often, television advertisements focus upon source or emotional aspects (page 121). The research findings cannot be generalized to these alternative formats: (iv) by conventional standards, audio and video presentation speeds were quite rapid. That is, a 168 WPM speaking rate and a 0.9 second/frame video pace were employed. Subjects reported that the visual scenes changed with unusual rapidity. Similar complaints were not made about the audio. Recall that perceptual limitations are directly related to presentation speeds. Since the experimental treatments incorporated above-normal speeds, the more relaxed pace of conventional advertisements could obviate selective attention problems. Hence, the research findings might not be generalizable to these slower formats; (v) in four of the six treatments, A and V were disjoint as opposed to simultaneous. The tactic is not often used in present-day advertising. Hence, the experimental commercials were somewhat unique. The unusual design probably generated nonnormal attention levels among Ss. This artifact is a feasible alternative explanation for the research findings. The results from unique presentations cannot necessarily be generalized to more conventional designs; (vi) the visual portion was constructed by videotaping 17 still slides. Hence, cuts from one stationary scene to another, rather than moving background V was employed. The current findings do not necessarily apply if moving video is shown, since longer presentation times and greater intrachannel redundancy are likely.

Redundancy Manipulations

In this dissertation, redundancy was defined as identical information being simultaneously presented on more than one channel (i.e., a verbal message appeared pictorially on the screen while the identical words were spoken by an announcer). Hence, several gradients of redundancy were not examined: (i) aural verbal spoken by an announcer who appears on the screen; (ii) intrachannel repetition; and (iii) audio (visual) representations of visual (audio) stimuli (e.g., the word 'box' is spoken while a box simultaneously appears on V).

The showing of content similar material on two or more stimulus channels was called incomplete redundancy. Manipulations concerning the degree of similarity were not conducted.

Research conclusions about completely redundant formats are not generalizable to situations where alternative types of redundancy obtain. Similarly, incompletely redundant findings may not apply if greater or lesser interchannel content similarity exists than was the case in treatment advertisements.

Experimental Setting

Most subjects reported that they concentrated more intently while watching the experimental videotape than they did while watching ordinary in-home broadcasts. Hence, a more active learning task obtained than is likely during conventional television advertisements. This artifact was expected to qualitatively influence the completely-redundant treatment data. Thus, the conclusions are not generalizable to the more realistic passive learning environments.

Measure of Attention

Short-term recall was used as a surrogate measure of attention. If information was recalled, it was either attended or chosen by fortuitous guessing. Material not recalled may or may not have been attended. That is, incorrect recounting of attended stimuli could have obtained because the individual was unable to extract the information from memory storage. To the extent that memory failures occurred, attention levels were underestimated. Hence, the stimuli that Ss recalled was actually less than or equal to the stimuli attended.

Since attention was not directly measured, the conclusions might have emerged because of memory rather than perceptual limitations. The dissertation did not fully address this issue.

Recall Task

A multiple choice questionnaire was employed to ascertain the level of short term recall. This structured design facilitated grading by standardizing responses and by providing an unambiguous recall framework. More open-ended questions (e.g., write down everything you remember from the videotape broadcast) would probably have generated more abbreviated responses. Thus, it would have been difficult to determine how much of the treatment stimuli was attended. This determination was crucial to understanding the selective attention process. Thus, a multiple-choice format was selected. Two limitations were encountered: (a) guessing behavior was facilitated; and (b) the questions themselves may have contained cues which selectively favored certain of the multiple response choices. These testing instrument artifacts may have generated the experimental findings.

Narrowness of the Inquiry

For television commercial broadcasts, the following relationship is postulated:

$$Y = (Y_1, Y_2) = f(X_1, X_2, \ldots, X_{21}),$$

where

- Y is recall of 'important' audio and video information bits;
- Y_1 is recall of 'important' audio information bits;
- Y_2 is recall of 'important' video information bits;
- X_1 is audio 'important' information presented;
- X_2 is video 'important' information presented;

X_3 is interaction between nonredundant A and V important information;

X_4 is interaction between nonredundant A important information and V unimportant information;

X_5 is interaction between nonredundant V important information and A unimportant information;

X_6 is interaction between redundant A and V important information;

X_7 is pre-alerting due to instructions;

X_8 is loudness of environmental noise (i.e., environmental distraction);

X_9 is speed of presentation;

X_{10} is order of recall questions;

X_{11} is time delay before recall task;

X_{12} is size of visual display;

X_{13} is color of visual display;

X_{14} is age of viewer;

X_{15} is loudness of audio display;

X_{16} is length of presentation;

X_{17} is complexity of the commercial;

X_{18} is uniqueness of presentation;

X_{19} is rate of perceptual channel switching;

X_{20} is excitation level of the viewer; and

X_{21} is interest level of the viewer.

Across all experiments, X_7 through X_{16} were held constant. No attempt was made to fully control X_{20} and X_{21}. However, it was assumed that general excitation and interest levels were normally distributed among Ss. The levels of the remaining independent measures varied with the experimental conditions. It is hypothesized that:

1. $\frac{\Delta Y}{\Delta X_7} > 0$ [95]

2. $\frac{\Delta Y}{\Delta X_8} < 0$ [41,42,46,59,60,68,94,95,112,129]

3. $\frac{\Delta Y}{\Delta X_9} > 0$ at slow speeds and <0 beyond some rate of speed [5,12,15,49,107,128]

4. $\frac{\Delta Y}{\Delta X_{10}} > 0$ for questions moved closer to the beginning of the questionnaire

5. $\frac{\Delta Y}{\Delta X_{11}} < 0$

6. $\frac{\Delta Y_2}{\Delta X_{12}} > 0$ [106,121]

7. $\frac{\Delta Y_1}{\Delta X_{13}} < 0$ and $\frac{\Delta Y_2}{\Delta X_{13}} > 0$.

   Color broadcasts are assumed to have higher attention values than black and white displays.

8. $\frac{\Delta Y}{\Delta X_{14}} < 0$

9. $\frac{\Delta Y_1}{\Delta X_{15}} > 0$ up to a certain loudness level and <0 beyond that point

10. $\frac{\Delta Y_1}{\Delta X_{16}} < 0$ [104]

11. $\frac{\Delta Y}{\Delta X_{17}} > 0$ for simple displays and <0 for complex formats [58,108,121,132]

12. $\frac{\Delta Y}{\Delta X_{18}} > 0$ [57,121]

13. $\frac{\Delta Y}{\Delta X_{19}} < 0$ if switching rate is rapid [101]

14. $\frac{\Delta Y}{\Delta X_{20}} > 0$ unless the excitation level is so high that it interferes with learning [121]

15. $\frac{\Delta Y}{\Delta X_{21}} > 0$ [121].

Since the experiments dealt with perceptual limitations, test commercials were complex, with information presented at fairly rapid speeds. The following variables were held constant across all treatments: instructions, loudness of environmental noise, speed of presentation, order of recall questions, time delay before recall task, size of visual display, color of visual display, age of viewers, loudness of audio, and length of presentation.

The research findings were based upon preset levels of variables X_1 through X_{21}. Different results could have obtained if these explanatory measures were manipulated individually or in combinations. Hence, the conclusions are specific to the variable levels employed. Generalizing to other situations is unwarranted.

The dissertation research is also narrow in other respects. First, the effect of repetition of commercials upon the level and variability of attention (recall) was not addressed. Only single presentations of commercials were shown. Second, cognitions and affect toward, as opposed to recall of televised commercials were not examined. Third, the dissertation did not address interference between simultaneous musical and spoken auditory, and between printed and background visual. Fourth, equations 4 and 6 (pages 20, 21) delineate the probabilities that viewers will attend to designated input channels during any instant of a television commercial. The current research did not indicate how to maximize these probabilities. Rather, the focus was upon maximization under the assumption that predetermined advertising copy obtained. Hence, strategies that will globally maximize

$$\sum_{i=1}^{m} P(AI_i)$$

require the development of copy formats generating highest probabilities that viewers will attend to a single channel instead of alternate stimuli. Finally, identifying and characterizing those audience members who will most actively attend to single channels was not attempted.

Suggested Directions for Future Research

Before enlarging the research approach, various replication studies should be considered. Specifically, using larger and more representative samples, more conventional advertising copy, different gradients of redundancy, a passive learning context, and direct attention measures are recommended. Then, widening the inquiry is suggested.

Larger and More Representative Samples

Recall that small, nonrandom samples were employed. Replication based upon large, randomly selected groupings would provide evidence more generalizable to the larger television viewing audience.

More Conventional Advertising Copy

In conjunction with more representative sampling, improving the quality of experimental advertisements is recommended. That is, replicate with professional quality commercials. Moreover, several types of copy design might be deployed. First, examine advertisements varying in amount of information content. The present study only looked at high-content messages. Second, evaluate copy that focuses upon source and/or emotional aspects in addition to copy targeted at product-related claims. Third, examine numerous levels of presentation speeds for the audio and video tracks. It is important to determine the minimum projection rates at which perceptual limitations emerge. Fourth, to minimize uniqueness of display, sequence disjoint A and V tracks in ways other than the dissertation format (i.e., the entire A track followed by the entire V track). For example, show five seconds of V, then five seconds of A, and so on. The objective is to ascertain the optimal deployment of alternate channels in single-channel designs. Finally, employ moving background video instead of sequences of still slides.

Difference Gradients of Redundancy

As a further suggestion, replicate the selective attention experiments with alternate types of redundancy manipulations. That is, deploy intrachannel repetition, aural verbal spoken by an on-screen announcer, and audio (video) representations of video (audio) stimuli. Furthermore, the degree of interchannel content similarity can be manipulated. At some level of dissimilarity, secondary channels are irrelevant distractions to the primary-channel message. The findings would contribute to an understanding of the currently unresolved distraction hypothesis controversy.

Passive Learning Context

The dissertation research was conducted in an active learning environment. The laboratory setting and experimental instructions were responsible. A passive learning context is more realistic for television commercial viewing. Hence, creating passive settings is recommended for future selective attention research.

Direct Attention Measures

The current study used short-term recall as a surrogate for attention. Future research could focus more directly upon attention measures. Since post-exposure verbal recall measures retention rather than attention, alternative laboratory measures are required. Techniques most frequently used include: (1) galvanic skin response; (2) pupil dilation response; (3) eye movement camera; (4) tachistoscope; and (5) binocular rivalry. Employing one or more of these methods in television advertising experiments is recommended. Otherwise, only inferences about attention are renderable, with memory processes confounding the results. However, realistic television viewing contexts are sacrificed when the cumbersome attention measuring equipment is deployed. Hence, the implications of methodological tradeoffs should be considered.

Widening the Inquiry

Once suitable replications have been conducted, the focus of inquiry can widen. The following variables may be manipulated: previewing instructions, loudness of environmental noise, order of recall questions, time delay before the recall task, size of the visual display, color of the visual display, loudness of audio, and length of presentation.

Other addressable issues include effects of repetition of commercials upon the level and variability of attention (recall); cognitions and affect toward, as opposed to recall of television commercials; interference between simultaneous musical and spoken auditory, and between printed and background visual; presentation format(s) generating highest probabilities that viewers will attend to a single channel instead of alternate stimuli; and identifying and characterizing those audience members who will most actively attend to single channels.

Summary

Chapter V discusses the experimental findings in terms of Broadbent's conceptual scheme. The results provided supportive evidence that selective attention operates within television commercial viewing settings. That is, audio and video information cannot be attended simultaneously. Empirical and managerial implications are then discussed. The focus is upon delineating variables which indicate appropriate channel strategies under alternative objectives, customer profiles, and corporate contexts. Under certain conditions, single-channel formats are recommended. In others, use of multiple or mixed-channels is advised.

The chapter includes a section that addresses the significance of this dissertation to selective attention theorists as well as to business and public policy groups.

The chapter concludes with discussions of research limitations and suggestions for future studies which would improve the theory and practice of advertising copy design.

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APPENDIX A

RECALL QUESTIONNAIRE

Please answer all of the following questions related to the advertisement you saw embedded in the introductory segment of the Happy Days television show. Leave no questions unanswered. Answer the questions in the order given. Do not skip any questions. There is no time limit.

(1) The product type advertised was (circle one answer only)

a) instant pancake mix
b) corn muffin mix
c) blueberry muffin mix
d) cupcake mix
e) browny mix
f) I don't remember

(2) It was stated that brands other than the one advertised (circle one answer only)

a) rarely give
b) sometimes give
c) often give
d) usually give
e) always give
f) I don't remember

products that are (circle one or more answers)

a) dry
b) tough
c) crumbling
d) tasteless
e) bitter
f) unsweet
g) too sweet
h) rubbery
i) I don't remember

(3) However, the following brand was claimed not to have the abovementioned weaknesses (circle one answer only)

a) Baxter's Brand
b) Maxwell's Brand
c) Betty Crocker's Brand
d) Mixo Brand
e) Granny's Brand
f) I don't remember

(4) It was stated that the advertised brand contains (circle one answer only)

a) saccharine
b) maple syrup
c) lecithin
d) glycerin emulsifiers
e) cherry root
f) I don't remember

(5) The advertiser verbally guaranteed that the advertised brand gives products that are (circle one or more answers)

a) chewy
b) flavorful
c) crunchy
d) honey-dipped
e) moist
f) dietetic
g) spicy
h) flaky
i) I don't remember

(6) The advertised brand is available in which of the following sizes (circle one or more answers)

a) 2 oz.
b) 4 oz.
c) 6 oz.
d) 8 oz.
e) 10 oz.
f) 12 oz.
g) 14 oz.
h) 1 lb.
i) I don't remember

(7) It was claimed that the brand advertised is priced (circle <u>one</u> answer only)

a) 10% below
b) 15% below
c) 30% below
d) 10% above
e) 15% above
f) I don't remember

which among the following (circle <u>one</u> answer only)

a) other local brands
b) all other brands
c) its largest competitor
d) non-instant brands
e) national brands
f) I don't remember

(8) It was stated that the brand advertised comes in a box having the following color(s) (circle <u>one or more</u> answers)

a) green
b) white
c) blue
d) black
e) grey
f) brown
g) yellow
h) purple
i) I don't remember

(9) Which brand(s) of the product type advertised were shown on the screen (circle <u>one or more</u> answers)

a) Washington
b) CC
c) Country
d) Jiffy
e) Crocker's
f) BB
g) Bakewell
h) Flako
i) I don't remember

(10) Which, if any, of the following did you see on the screen (circle one or more answers)

a) cakes floating in bowl of water
b) butter on a knife over pile of crumbs
c) sandy gravel pouring out of a small box
d) garbage can filled with discarded muffins
e) soggy roll being eaten by insects
f) burnt muffins in muffin tin
g) several small cakes surrounded by flames
h) moist batter pouring out of a small box
i) I don't remember

(11) Which, if any, of the following did you see on the screen (circle one or more answers)

a) young adult bearded male
b) young adult bald male
c) young adult female
d) elderly male
e) elderly female
f) middle aged male
g) pair of middle aged males
h) pair of elderly females
i) I don't remember

(12) If you did see any adult(s) in the ad, indicate the way(s) they appeared on the screen (circle one or more answers)

a) facing camera, smiling, with uplifted arm and raised index finger
b) facing camera, hands on hips, with angry expression on face
c) lying on the floor, face up, smiling
d) facing camera, smoking a cigarette, looking nervous, with frown on face
e) turned sideways in kneeling position, taking cakes out of oven
f) lying face down on the floor
g) facing camera, with head bent down in look of sadness
h) turned sideways, laughing, with hands on stomach
i) I don't remember

(13) Which, if any, of the following did you see on the screen (circle <u>one or more</u> answers)

a) glass bowl half filled with water
b) cup filled with blueberries
c) glass bowl three-quarters-filled with batter
d) metal bowl half-filled with batter
e) glass bowl less than half-filled with batter
f) butter dish with quarter pound stick of butter on it
g) metal bowl completely-filled with honey
h) small cup half-filled with batter
i) I don't remember

(14) Which, if any, of the following did you see on the screen (circle <u>one</u> answer only)

a) egg(s) in small saucer
b) chocolate kiss(es) in small saucer
c) peanut(s) in small saucer
d) plum(s) in small saucer
e) grape(s) in small saucer
f) I don't remember

(15) Referring to your answer to question #14, how many of the indicated items were in the small saucer (circle <u>one</u> answer only)

a) one
b) two
c) three
d) four
e) five
f) I don't remember

(16) Which, if any, of the following did you see on the screen (circle <u>one or more</u> answers)

a) clock set at 11:30
b) clock set at 12:00
c) clock set at 12:15
d) clock set at 12:30
e) clock set at 1:00
f) clock set at 2:30
g) clock set at 6:00
h) clock set at 9:00
i) I don't remember

(17) Which, if any, of the following did you see on the screen (circle <u>one or more</u> answers)

a) Skippy's peanut butter jar held over tray of muffins
b) tray of muffins on top of refrigerator
c) bottle of milk held over bowl containing batter
d) container of cinnamon held over tray of muffins
e) jar of molasses held over bowl containing batter
f) bag of flour held over bowl containing batter
g) glass-faced toaster oven containing tray of muffins
h) whip cream container held over tray of muffins
i) I don't remember

(18) Which, if any, of the following did you see on the screen (circle <u>one or more</u> answers)

a) loaf of Arnold's Naturel Bread
b) two oranges
c) three cans of creamed corn
d) two ears of corn
e) loaf of Wonder Bread
f) four pine cones
g) two coconuts
h) loaf of French Bread in paper bag
i) I don't remember

(19) Which, if any, of the following did you see on the screen (circle <u>one or more</u> answers)

a) empty cupcake tin
b) plate filled with two muffins and one doughnut
c) jar of Polaner Grape Jelly
d) three cupcakes on a plate
e) jar of Welch's Grape Jelly
f) six muffins in muffin tin
g) one muffin with knife, butter and jelly on top
h) jar of Ovaltine
i) I don't remember

(20) Which, if any, of the following <u>words</u> appeared on the screen (circle <u>one</u> answer only)

a) ONE HOUR LATER
b) 50 MINUTES LATER
c) 20 MINUTES LATER
d) 10 MINUTES LATER
e) 5 MINUTES LATER
f) I don't remember

(21) Which, if any, of the following <u>words</u> appeared on the screen (circle <u>one</u> answer only)

a) REGULARLY 25¢/SERVING
b) REGULARLY 20¢/BOX
c) USUALLY 25¢/BOX
d) USUALLY 20¢/SERVING
e) 25¢/SERVING
f) I don't remember

(22) Which, if any, of the following <u>words</u> appeared on the screen (circle <u>one</u> answer only)

a) 2-FOR-1 SALE
b) 1/2 PRICE DURING APRIL
c) 20% SALE DURING JUNE
d) 1/3 OFF UNTIL MAY
e) 1/2 PRICE UNTIL JUNE
f) I don't remember

APPENDIX B

DEBRIEFING QUESTIONNAIRE

1. What do you think was the purpose of this experiment?

2. Did you have any previous knowledge of or experience with any of the products shown in the advertisement? If so, which one(s)?

3. Did you behave differently (e.g., concentrated more or less) while watching the experimental film clip than you ordinarily do while watching television? If so, how?

4. Have you talked about this experiment with anyone who already participated in it? If so, what did they tell you about the experiment?

5. Thank you for your cooperation. Please do not discuss this experiment with others until April 8, when data collection is completed.

A P P E N D I X C

PHOTOGRAPHS OF SLIDES OF VIDEO TRACK SCENES*

*Slides 12, 16, and 17 are not shown since they consisted of on-screen printing.

Photograph of Slide 1.

Photograph of Slide 2.

Photograph of Slide 3.

Photograph of Slide 4.

Photograph of Slide 5.

Photograph of Slide 6.

Photograph of Slide 7.

Photograph of Slide 8.

Photograph of Slide 9.

Photograph of Slide 10.

Photograph of Slide 11.

Photograph of Slide 13.

Photograph of Slide 14.

Photograph of Slide 15.